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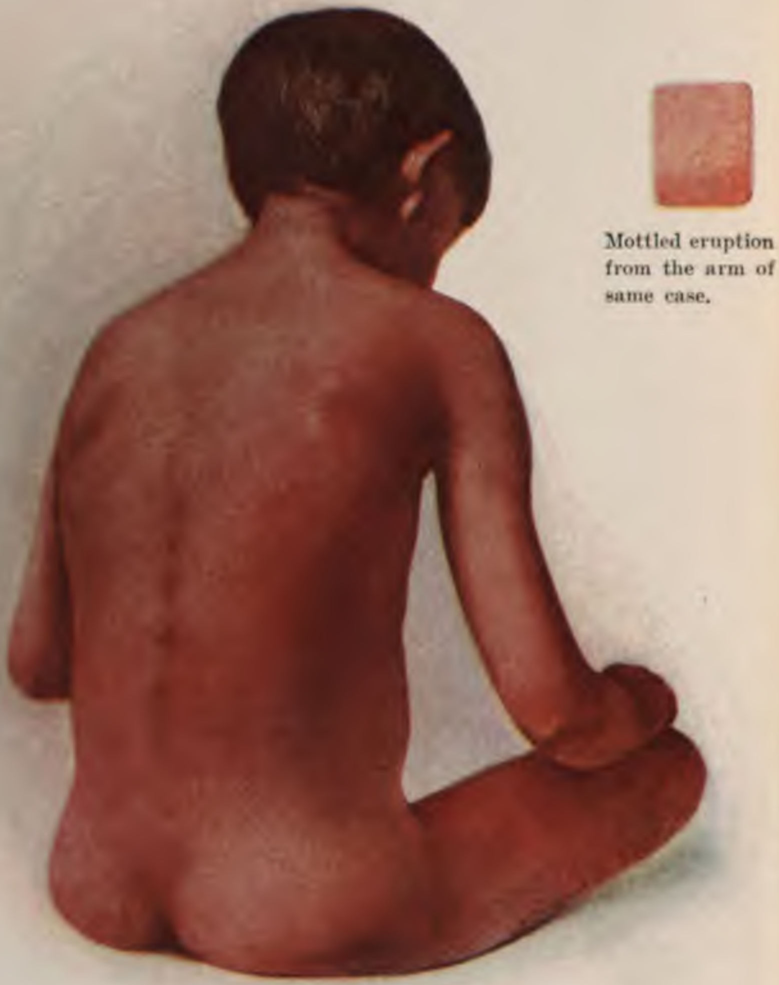
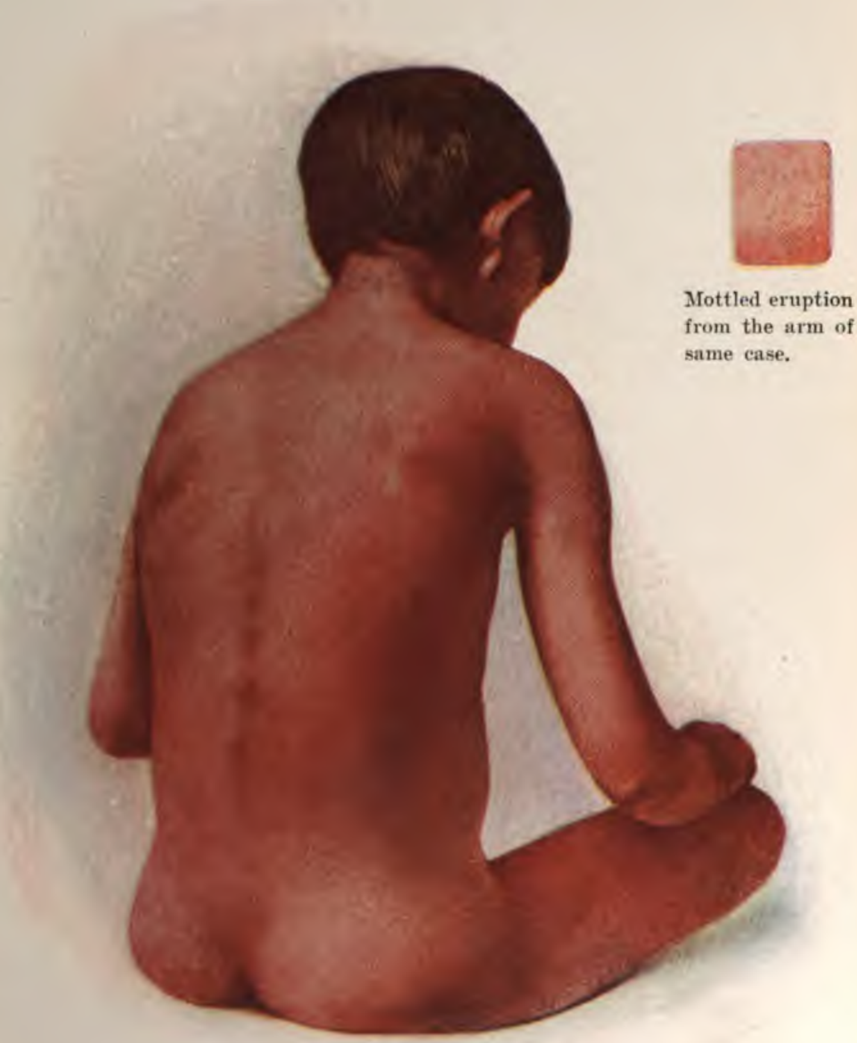
PLATE I


Mottled eruption from the arm of same case.

Severe Case of Scarlet Fever, showing eruption at its height. For strawberry tongue of same case, see Plate XVII. (Original.) (Painted from a case in the Riverside Hospital.)

PLATE I



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DISEASES
OF
INFANCY AND CHILDHOOD
THEIR
DIETETIC, HYGIENIC, AND MEDICAL TREATMENT

A TEXT-BOOK DESIGNED FOR PRACTITIONERS
AND STUDENTS IN MEDICINE.

BY
LOUIS FISCHER, M.D.
ATTENDING PHYSICIAN TO THE WILLARD PARKER AND RIVERSIDE HOSPITALS OF NEW YORK CITY
ATTENDING PEDIATRIST TO THE SYDENHAM HOSPITAL; FORMER INSTRUCTOR IN DISEASES
OF CHILDREN AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL,
ETC., ETC.; FELLOW OF THE NEW YORK ACADEMY OF MEDICINE.

SECOND EDITION

*WITH THREE HUNDRED AND THREE ILLUSTRATIONS, SEVERAL
IN COLORS, AND TWENTY-SEVEN FULL-PAGE
HALF-TONE AND COLOR PLATES.*

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Philadelphia, Pa., U. S. A.
Press of F. A. Davis Company,
1914-16 Cherry Street

ADOLF BAGINSKY, M.D.

PROFESSOR OF DISEASES OF CHILDREN AT THE BERLIN UNIVERSITY, AND
DIRECTOR OF THE EMPEROR AND EMPRESS FREDERICK
CHILDREN'S HOSPITAL, BERLIN,

AS A TOKEN OF GRATITUDE FOR HIS MANIFOLD COURTESIES
THIS WORK IS MOST

AFFECTIONATELY INSCRIBED.

41138

PREFACE TO THE SECOND EDITION.

THIS book has undergone a careful revision. In many articles changes have been made. Some articles have been elaborated, for example—in the treatment of Nephritis, the Salt Free Diet has been added. In the article on Tuberculosis some changes were made and a description of an aid to the diagnosis by means of Tuberculin Inoculation has been added. A new article dealing with Hypertrophic Pyloric Stenosis has also been added. Many other changes will be found in the text of the various articles.

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LOUIS FISCHER.

PREFACE.

RAPID strides have been made in the diagnosis and especially in the treatment of diseases in children. The twentieth century has perfected many dark points in pediatrics. Along with the progress in diagnosis therapeutics has been entirely remodeled.

The development of bacteriology has added new methods of diagnosis, aided prognosis, and further perfected specific treatment for various infectious diseases. A comparison of the treatment of diphtheria in vogue twenty years ago with that of the antitoxin treatment of to-day, is cited as an instance of progress. The operation of intubation instead of tracheotomy for acute and subacute obstruction to the upper air passages is another instance of progress in therapeutics.

Our advance in the diagnosis and the modern treatment of tuberculosis has been the means of saving many lives.

In this work, infant-feeding in all its phases, maternal nursing, wet nursing, and hand feeding with all home modifications for bottle feeding, are carefully considered and given special attention. The disorders arising from improper feeding have been given prominence owing to the importance of the subject.

The growing child is very susceptible to infectious diseases, hence this important part has received my most earnest attention. The diseases of the digestive tract and diseases of the respiratory tract have in their turn been considered.

Clinical observations in Europe, as well as while in [illegible] as an attending physician to the large service of the Riverside and Willard Parker Hospitals, have given me an abundant opportunity for comparing various methods of treatment.

This book has been divided into twelve parts:—

I. The New-born Infant.
II. Abnormalities and Diseases of the New-born.
III. Feeding in Health and Disease.
IV. Disorders Associated with Improper Nutrition, and Diseases of the Mouth, Œsophagus, Stomach, Intestines, and Rectum.
V. Diseases of the Heart, Liver, Spleen, Pancreas, Peritoneum, and Genito-urinary Tract.

VI. Diseases of the Respiratory System.
VII. The Infectious Diseases.
VIII. Diseases of the Blood, Lymph Glands or Nodes, and Ductless Glands.
IX. Diseases of the Nervous System.
X. Diseases of the Ear, Eye, Skin, and Abnormal Growths.
XI. Diseases of the Spine and Joints.
XII. Miscellaneous.

The greatest stress has been laid on the diagnosis, symptoms, and treatment which are so necessary at the bedside. Pathology and more especially Bacteriology have been given ample consideration.

An intimate acquaintance with the needs of the physician, while teaching Diseases of Children at the New York Post-graduate Medical School and Hospital, has proven the value of photographic and color plates to express the true nature of disease. For this reason, in almost every article, I have used liberally, clinical and pictorial illustrations of cases.

Due credit has been given in the text for some photographs loaned to me. The staffs in the various hospitals have given me liberal assistance and, in many instances, practical advice.

I desire to acknowledge the kind assistance of Drs. D. Ashley, H. T. Brooks, Wolf Freudenthal, Archibald E. Isaacs, Herman Jarecky, M. D. Lederman, and L. S. Manson for suggestions in the special articles pertaining to orthopedics, pathology, ear, eye, throat, and nervous systems.

Most of the original half-tones and colored illustrations were made by Mr. Henry C. Lehmann. I am especially indebted to him for painstaking care in the illustrations of diphtheria and scarlet fever made for me at the bed-side of cases in the hospital. I desire to acknowledge the liberality and uniform courtesy which my publishers have extended to me.

LOUIS FISCHER.

65 East Ninetieth Street,
New York City.

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LOUIS FISCHER.

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PART I.

THE DEVELOPMENT AND HYGIENE OF THE INFANT. DIAGNOSTIC SUGGESTIONS.

CHAPTER I.

INFANCY AND CHILDHOOD.

THE NEW-BORN INFANT.

THERE are several anatomical and physiological changes which occur when an infant passes from a passive intrauterine to an active extrauterine existence. The lungs have had no intrauterine function. They become active as soon as the infant makes its first inspiration. The stomach and bowels become active the moment the first mouthful of food is swallowed. The blood-vessels of the umbilical cord, which have nourished the child and connected it with the circulatory system of its mother, rapidly atrophy as soon as breathing is established. The following are the most important changes that take place during the first month of an infant's life:—

1. The meconium is expelled.
2. The umbilical cord separates.
3. The navel becomes cicatrized.
4. The epidermis cracks and falls off.
5. The hair is renewed.
6. The umbilical vessels are obliterated, and the foramen ovale is closed.

Infancy.—The term infancy is best applied to that period from the end of the first month until all of the milk teeth have appeared, which is about the end of the second year of life.

There are certain anatomical peculiarities which may be important to mention, namely:—

1. The thymus gland.
2. The large size of the liver.
3. The existence of an anterior and posterior fontanel.

Childhood.—The term childhood is applied to that period from the end of the second year to about the sixteenth year.

Childhood ends when puberty begins. Then follows the stage of *adolescence.*

CHAPTER II.

THE DEVELOPMENT OF THE VARIOUS SENSES.

MENTAL FACULTIES.[1]

THE following is the order in which the various senses appear developed: taste, sight, touch.

Reflex Actions.—Yawning may begin at the end of the first week of life.

Sighing commences in the twenty-eighth week.

Urine is passed and attention called to it by the infant between the thirty-sixth and fortieth weeks. From this time on it is advisable to try to train the child to be clean and use a chair.

Suckling or Nursing.—This seems to be congenitally acquired. Between the eighth and tenth months an infant should know enough to properly guide a nursing bottle to its mouth. It should also know enough to properly inspect its various toys at this age.

Supporting the Head.—The infant should support its head for a few moments in the fourteenth week, and should be able to properly support the head about the sixteenth week.

Sitting usually commences between the seventeenth and twenty-sixth weeks. The child should be able to properly support the body between the thirty-sixth and fortieth weeks. About the forty-second week the child should be strong enough to support its back thoroughly. Commencing with the forty-fifth week the sitting position should be permanently established.

When children can sit up and play they should be placed on the floor, having a clean rug under them. Active movements can be suggested by rolling a small ball or giving the child some toy to play with. The tendency to put everything into the mouth must be considered. Hence, large toys, such as hollow rubber balls, are best. Playing with beans, peas, and bullets has frequently given many a physician an opportunity to try his skill in removing them from such places as the middle ear, the nostril, and most frequently the stomach.

Stamping with the feet in the forty-fourth week.

The first attempts at walking appear about the forty-first week. *Walking* unaided is rare before the end of the first year. Two-fifths of all children learn to walk between the fourteenth and fifteenth months. Thus children must not be expected to walk properly until they are one and a half years old.

---

[1] The brain, fontanel, and reflexes of the body are described in detail in Part IX, "Diseases of the Brain and Nervous System."

Children having suffered with disordered stomach and bowels, whether from faulty feeding or inherited disease (syphilis) or other organic disorders, may, if urged to walk in this weakened condition, invite deformities, such as bow-legs.

Children will not *jump, climb, throw things, or turn* unaided before they are between two and three years old.

Infants do not learn to *imitate* before the twenty-eighth week.

Laughing begins as early as the eighth, sometimes not before the seventeenth week. An infant will laugh heartily with tears in its eyes about the forty-fourth week. The mouth will show an expression the moment the infant's attention is attracted, between the third and seventh week.

Kissing with the lips usually at the fifteenth month.

Tears, when crying, can be noticed after the tenth week.

Memory.—The memory of an infant can be noticed sometimes before the thirtieth week.

The *taste of milk,* the *sense of feeling,* the *sight of the mother,* the *presence of the father or the nurse,* are distinctly apparent about this same time. An infant will notice the absence of its mother about the fourth month, and also notice the difference in the sound of the voice. The *memory* seems to be most acute in the fourth year of life. It is surprising to see how much children will remember, and how acute their mental faculties will be in the fourth year of life.

Voice Sounds.—Children will study the movements of the mouth of adults, and will learn to note the difference in sound. They will remember the meaning of words, especially when brought into use in connection with certain objects or places. Words will be uttered in accordance with no distinct rule. This is a peculiar individuality which is difficult to record. One child will speak ten words at the age of ten months, and be in a normal condition. Another child will speak but six words at the age of sixteen months and yet be physically and mentally in a normal condition. This shows the marked difference in various children in apparently good health.

VERY LATE SPEAKING, SLOW DEVELOPMENT, GOOD PROGNOSIS.[1]

The center of speech may be inactive, and show no signs of development until the end of the second year. If the child is otherwise healthy no alarm need be felt at this state of affairs. If, however, the child is backward in its physical development as well as its mental development, then treatment must be sought to remedy this condition. If a child has rickets, its soft bones and flabby muscles require restorative treatment.

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[1] See article on "Alalia Idiopathica," Part IX.

SUDDEN LOSS OF SPEECH DUE TO PARALYSIS.

If an infant shows proper development, commences to speak, and for no apparent reason stops speaking, the cause of the condition should be carefully investigated. For example: A child suffering from a severe infectious disease, like diphtheria, may, during convalescence, develop paralysis, which might cause the sudden cessation of speech. The neglect of treatment at such a time may result in permanent injury to the child.

CHAPTER III.

THE DEVELOPMENT OF THE BODY.

GROWTH AND HEIGHT.

THE average height of the new-born male is from 19 1/2 to 20 inches (about 50 centimeters). In the female from 19 1/4 to 19 3/4 inches (about 48.5 centimeters). Holt's average is one inch more in both male and female children at birth. A child grows most rapidly during its first year.

TABLE NO. 1.

Increase during	
First year	5 to 6 1/2 inches.
Second year	2 1/2 to 3 1/2 inches.
Third year	2 1/3 to 2 2/3 inches.
Fourth year	about 2 inches.
Fifth to sixteenth year	annual increase from 1 1/2 to 2 inches.
Sixteenth to seventeenth year	1 1/3 inches,
Seventeenth to twentieth year	1 inch yearly.

Diseases of the bones, rickets, and scrofula retard growth. A child should begin to walk at the end of twelve months. If a child, when commencing to walk, uses chiefly its toes and has a limping gait, more especially if symptoms of pain be noticed in one knee, and tenderness be caused by handling the limb, commencing hip-joint disease may be inferred.

DENTITION.

Dentition is regarded by most authors as a physiological process. Teeth are developed at birth and grow with the infant until they pierce the gum. A series of nervous disorders occur after the fourth month and during the eruption of the teeth. Such symptoms are a very warm mouth, red and inflamed gums, and an excessive secretion of saliva. Rachitic children and those having a highly sensitive nervous system will be very restless at night. They will roll the head and frequently cry with pain. A finger will usually be found between the gums and the child will try to bite everything within its grasp. These symptoms seem to disappear after the eruption of the tooth, so there seems to be some relation between the tooth and the symptoms described. Rotch states that in certain infants during the completion of the development of a tooth, symptoms connected with the ear will manifest themselves. The symptoms are usually produced by a congestion of the blood-vessels of the ear which is accompanied by pain and sometimes results in an inflammation.

Treatment of Inflamed Gums.—When the gums are tense and inflamed, severe nervous manifestations frequently exist. An incision made into the gums, deep enough to reach the tooth, has frequently been the means of producing relief by local depletion. Relieving the tense gum besides abstracting the blood has served me in some cases. The indiscriminate lancing of the gums must be warned against. In most cases local application will relieve. The application of a 1 to 5000 solution of adrenalin acts very well. It may be repeated every hour. A drop of laudanum on absorbent cotton placed in the middle ear seems to act well in some instances. In rare instances we will be told that a child has had convulsions. I must emphatically reiterate that such cerebral or nervous symptoms are apt to occur in the sick infant, and will never occur in the healthy infant.

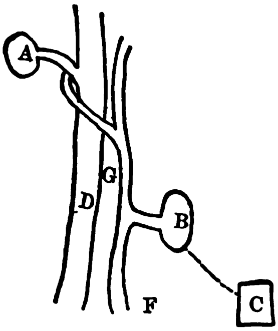

Fig. 1.—A, tympanic cavity; B, otic ganglion; C, tooth; D, internal carotid; E, tympanic branch; F, auriculo-temporal nerve; G, auricular branch of auriculo-temporal nerve. The dotted line connecting B and C represents the inferior dental nerve. (Rotch.)

The association of bronchitis or diarrhœa must be looked upon as entirely independent of dentition. The laity are very willing to ascribe most disorders arising at or about the period of dentition as due to the teething. The following case will illustrate how careful one must be not to be guided by the statements of irresponsible persons, and diagnose dentition:—

A child, fifteen months old, was seen by me in consultation. This was a well-nourished, breast-fed infant, and had four incisors, two upper and two lower. The mother stated that the child had had a cough and fever at and before the appearance of each tooth. She was very emphatic in stating that her baby was "teething." There was anorexia and slight constipation. A dose of castor-oil was given, but the symptoms continued. The child was very thirsty and seemed to lose flesh. The temperature in the rectum was 103° F., pulse 150, respiration 30. An examination of the chest showed moist râles and quite diffuse rhonchi. There was a marked area of dullness and bronchial breathing in the upper lobe of the right side. The diagnosis of pneumonia was made. Four or five weeks later I again saw this child. The

cough still existed and a suspicion of whooping cough was expressed. An exploratory puncture showed pus. The diagnosis of empyema was made. The child was operated upon and made a brilliant recovery.

The teeth usually appear, according to Professor Baginsky, between the third and tenth months. The usual rule is for normal dentition to begin about the seventh or the eighth month.

In a great variety of children premature teething is recorded; I have seen a great many children born with two or more teeth.

Rachitic children, as a rule, teeth very early or very late. In the large children's service with which I have been connected I have observed the eruption of teeth many times as early as two or three months in very rickety, bottle-fed children. These teeth soon decay, and are then known as carious teeth.

In syphilitic (congenital) children premature dentition is frequently seen.

The first teeth are known as *milk-teeth.*

The following table will show the usual rule followed by normal dentition in the average child:—

TABLE No. 2.

19	11	13	5	3	4	6	14	9	17
20	12	15	7	1	2	8	16	10	18

The milk-teeth are twenty in number; thus, one and two are the lower incisors, usually first teeth; then follow three and four, upper incisors.

Normal children usually teeth in pairs, and not singly, whereas rachitic children usually have an eruption of single teeth, and distinct backwardness in their appearance. Deciduous teeth, commonly called milk-teeth, remain until a child is 6 years old, when the permanent teeth appear.

Baginsky emphasizes the fact that enough stress is not laid on the clinical importance of carious teeth as indicating tuberculosis and scrofulous conditions. In the section on treatment of rickets I have mentioned the value of a nitrogenous diet, especially proteids (albuminoids), to aid in the formation of bony structures. The teeth are also included in this category.

Thus, when such drugs as glycerophosphate of lime or iron and hygienic measures are indicated for the treatment of rickets they are of especial value when backwardness in teething exists.

When diarrhœa or cholera infantum cleanses the system and when the disease is arrested or well under way, normal physiological conditions, such as dentition previously delayed, are vigorously continued. Frequently teeth will appear immediately following such an acute disease, thus an apparent delayed dentition, due to a pathological process, will be attributed by the laity to the disease or sickness called teething.

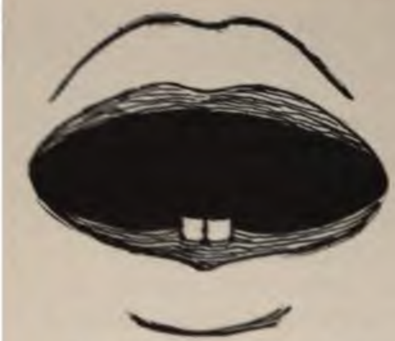

Fig. 2.—Two Middle Lower Incisors. Three to Ten Months; Average, Seven Months.

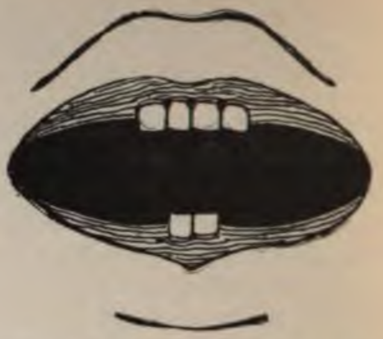

Fig. 3.—Four Upper Incisors. Nine to Sixteen Months.

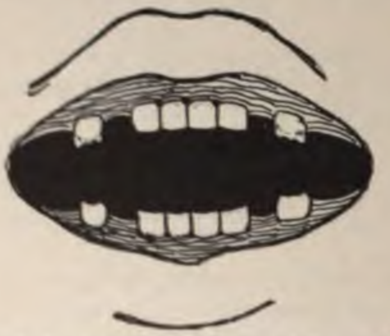

Fig. 4.—Two Lateral Lower Incisors and Four Anterior Molars. Thirteen to Seventeen Months.

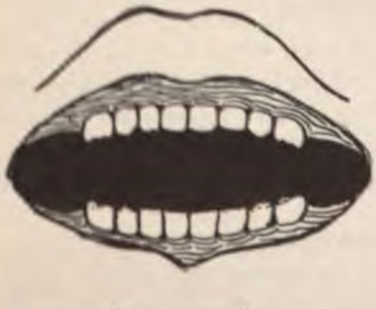

Fig. 5.—Four Canines. Sixteen to Twenty-one Months.

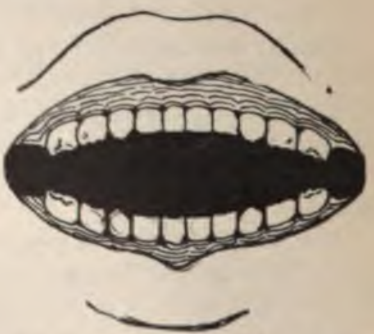

Fig. 6.—Twenty Milk Teeth. Twenty-three to Thirty-six Months, although the Average is Twenty-four to Thirty Months.

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[1] I am indebted to Dr. Dillon Brown for the illustrations, which have recently red in "The Nursery."

CHAPTER IV.

DIAGNOSTIC SUGGESTIONS.[1]

It is a very difficult matter to give as distinct clinical pictures of children in certain diseases as we can of adults. The following points are important enough to be noted:—

First.—There is an absence of expectoration in respiratory diseases. Infants cough and usually swallow their expectoration.

Second.—An absence of distinct chills and rigors as seen in adults.

Third.—The tongue, so valuable in adults as an aid to diagnosis, may frequently be overlooked as a symptom of importance in young children.

Fourth.—Very high temperature and pulse-rate may be associated with trivial, just as well as they only too frequently denote serious conditions. A normal temperature is frequently seen in septic diphtheria; we must therefore not judge a case by the temperature alone.

Fifth.—The great peristaltic activity and the anatomical difference in the shape of the stomach at birth render such symptoms as vomiting and diarrhœa trivial compared with what such symptoms would denote in an older and fully developed child.

Dr. West ably says: "You cannot question your patient, or, if old enough to speak, still, through fear, or from comprehending you but imperfectly, he will probably give you an incorrect reply. You try to gather information from the expression of his countenance, but the child is fretful and will not bear to be looked at; you endeavor to feel his pulse, he struggles in alarm; you try to auscultate his chest, and he breaks into a violent fit of crying." Such technical difficulties each medical man must try to overcome, and here it is that the ingenuity of the practicing physician is brought into play.

There are a great many important points which have a bearing upon the diagnosis and which it is well to formulate: First, try to examine the infant when asleep. Note the color of the face, if flushed or pale; the color of the lips if white or cyanotic; the condition of the skin, if dry or moist; if perspiration is confined to the head or forehead, or if it affects the whole body. Second, note the frequency and character of respiration, if painful or natural; moaning, twitching, or grinding of teeth; the action of the nostrils, if quiet or dilating; the eyes if closed, partly closed, or staring. Third, note the condition of the fontanels, if closed or open, if pulsating, if distended, full, and bulging, or if sunken.

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[1] The Babinski reflex, Kernig's sign, Tache cerebrale and the technique of lumbar puncture are described in detail in the chapter on "Meningitis." Part IX.

The pulse-rate should be noted. In counting the pulse-rate certain allowances must be made for excitement. The sudden slamming of a door, etc., will startle infants and cause the pulse to increase at times from ten to twenty beats.

The pulse varies in infants from 110 to 150. It may be irregular, consistently with health. After the seventh year it is found to be quicker in the female. It is sometimes slower during sleep. A very slow pulse is not always an indication of cerebral disease.

In a study of over 1000 children in health, the following average table of pulse was found (Fischer) :—

TABLE No. 3.

At birth	130 to 140
First year	115 to 130
Second year	100 to 115
Third year	90 to 100
Seventh year	86 to 96
Fourteenth year	84 to 94

TABLE No. 4.

	Pulse Rate:	
	While Asleep.	*Awake, Crying.*
Infant ten days old	146	164
One month old	150	176
Two months old	120	150
Three months old	112	148
Six months old	98	122
One year old	100	120
Two years old	98	108

A diagnosis can frequently be made by the condition of the pulse-rate added to the general condition. If an infant is suddenly taken ill with fever, with symptoms of nausea and vomiting, a dry coated tongue, and the pulse-rate about 130, we may look for an acute gastric fever. Such is usually the case if the history points to a diet of cake and pie, or cheese, in a very young child.

If, however, the child is feverish and vomits and the pulse-rate is between 70 and 80, then we should suspect tubercular meningitis rather than an acute febrile disease. Note the condition of the child's awakening; every young infant in a healthy condition awakens with a smile, does not frown, is not peevish.

Frequently, if the clinical history is looked into, we can learn just when the infant first became restless or showed some sign of disturbance. This will usually mark the beginning of an illness, if the same is an acute condition.

The Respirations.—From 1 to 2 years of age a child should breathe from 24 to 36 times in a minute. The breathing should be diaphragmatic in character; in ordinary breathing there should be no recession of the chest walls; this occurs in sobbing or if a mechanical impediment exists to the entrance of air into the lungs.

The number of respirations per minute ranges from 30 to 50; in early infancy 39 is the actual average.

TABLE No. 5.

From two months to two years, the average is 35.
From two years to six years, the average is 18 during sleep, 23 awake.
From six years to twelve years, the average is 18 during sleep, 23 awake.
From twelve years to fifteen years, the average is 18 during sleep, 20 awake.

Temperature.—The normal temperature of the child taken in the rectum varies between 99 $^{2}/_{5}$° to 100° F. Fever undoubtedly exists if temperature over 100° F. is noted. The cause should be searched for. No indication is more simple or more valuable than that supplied by the thermometer. By its aid alone we are often led to suspect the advent of typhoid or scarlet fever, or to detect some latent pneumonia, or tubercle producing irritation, or some other malady which we had overlooked. It should be remembered that *rigors* do not occur in very young children, but that *convulsions and delirium* correspond in a great measure to *rigors and headache* in an adult. The temperature is an important guide as to the condition of an infant. The pulse-rate and the character of the pulse are even more important.

Dr. Finlayson has bestowed much attention on the subject of temperature in young children, and his observations go to show:—

1. That there is a fall of temperature normally in the evening of 1°, 2°, or even 3° F.

2. This fall may take place before sleep begins.

3. It is usually greatest between 7 and 9 P.M.

5. The minimum is at or before 2 A.M.

5. After 2 A.M. it again rises, and that independently of food, etc., being taken—rises in fact during sleep.

6. The fluctuations between breakfast and tea are usually trifling.

7. The rise in a day to 104° or 105° F. precludes typhus and typhoid, not scarlatina.

8. In typhoid a gradual increase for the first four days with morning remissions is diagnostic (Wunderlich).

9. In tubercle the evening temperature is as high or, according to Dr. Ringer, higher than in the morning.

RULES TO BE OBSERVED IN TAKING TEMPERATURE OF INFANTS.

1. Be sure you have a good thermometer.
2. Inspect it and see that it is well shaken down to below normal before using it.
3. Anoint it with vaseline or oil.
4. Always use the rectum for infants.
5. Remember that infants always object to interference, hence the thermometer should be watched, otherwise an accident may happen.
6. The best position for the child is to lay it face downward on the nurse's lap.
7. Remember that impacted fæces in the rectum and fermentative conditions usually increase the temperature.

The Eye.—Squinting in acute illness is a grave prognostic; it may occur from reflex irritation or from paralysis, or from convulsions, but the convulsions may cease and the squint remain for awhile or even permanently. When strabismus occurs in tubercular meningitis, it is usually a fatal sign.

A small pupil is not so common as a large one; it occurs in active congestion, in opium poisoning, and in sleep. It should be remembered that the eye is always more or less turned up beneath the upper lid. Large pupils, if equal in size, are only of grave import when insensible to light; inequality of the pupils coming on in acute illness is a very grave prognostic. M. Jadelot has noticed that the form of the pupil is irregular in children suffering from the intestinal irritation of worms.

The following aphorisms of Bouchut are of practical value:—

1. In early childhood there is no relation between the intensity of the symptoms and the material lesion. The most intense fever with restlessness, cries, and spasmodic movements, may disappear in twenty-four hours without leaving any trace.
2. Abundant perspiration is not observed in very young children; it is entirely replaced by moisture.
3. Fever always presents considerable remissions in the acute diseases of young children.
4. In the chronic diseases of infancy, fever is almost always intermittent.
5. When children are asleep their pulse diminishes from 15 to 20 beats. The muscular movements which accompany cough, crying, agitation, etc., raise the pulse 15, 30, or even 40 pulsations.
6. The diseases of youth always retard the process of growth.

It is a good plan to auscultate the chest before resorting to percussion. The back of the chest is the most important to auscultate in a sick child. If there are no physical signs pointing to bronchitis or pneumonia in the back of the lungs, then it is unlikely that the front of the chest will show any signs. To be sure, however, both back and front of chest should be examined.

Dr. Vogel gives a valuable caution, viz., that *dullness on the right side posteriorly is a normal physiological condition.* Owing to abdominal pressure the abdominal organs, and notably the liver (as especially affecting the right side), is pressed upward.

Gestures are often significant. In brain disease the child puts its hand to its head, pulls at its hair, rolls its head on the pillow, and beats the air. In abdominal disease the legs are drawn up, the face is sunken and anxious, and the child picks at the clothes. In urgent dyspnœa it tears at its throat or puts its hand in its mouth, especially when false membranes are forming, or the tongue is much furred, as in fever, etc.

The cry varies; it is labored, as if half suffocated, or as if a door were shut between the child and the hearer, in pneumonia and capillary bronchitis; it is hoarse in croup, brassy and metallic, with crowing inspirations; in cerebral disease, especially in hydrocephalus, it is sharp, shrill, and solitary, the so-called "cri hydrocephalique," whereas in marasmus and tubercular peritonitis it is moaning and wailing. Obstinate and *long-continued crying* lasting for hours is referable usually to one of two causes; *earache* or *hunger.* A louder, shriller cry, also on coughing or produced in moving the child, is pleuritic. A cry accompanied with wriggling and writhing and preceding defecation is intestinal. M. Billard distinguishes between the cry and the return, the cry proper being the expiratory act, while the return occurs during inspiration. The cry proper is sonorous and prolonged; the return is shorter and sharper; the return is feeble in young infants, but increases in strength as the child grows older. It is the return that grows weak or ceases toward the end of all diseases. Moaning is especially characteristic of the alimentary canal.

The Tongue.—The following are the chief indications derived from observations of the tongue: 1. A furred tongue with whitish fur scattered over it indicates dyspepsia and intestinal irritation. 2. A red, dry, hot tongue points to inflammation of the mouth, stomach, etc. 3. Aphthæ often result from sheer starvation and neglect. 4. A pale flabby tongue marked at the edges with the teeth shows great debility. 5. White fur is generally indicative of fever. 6. Yellow fur of liver and stomach derangement of long standing. 7. Brown fur of a low typhoid condition. Besides these, special conditions, as the "strawberry tongue" of scarlatina, the glazed tongue of dyspepsia, etc., will be noted under the special diseases they characterize.

The Throat.—*No matter what the child suffers with, it is imperative to examine the throat.* Advantage can be taken of the infant while crying to observe the tongue, the teeth, the gums, the mouth in general, and the throat in particular. The neglect of an examination of the throat has frequently been the means of disseminating diphtheria. Many a child's life has been sacrificed by failure to make a minute examination of the throat.

Sleep.—Healthy infants normally sleep from eighteen to twenty hours out of the twenty-four. Thus, if infants are restless and do not sleep, such insomnia denotes illness.

Presuming that we have had an opportunity to examine the infant during sleep, let us then have the child undressed and notice the surface of the skin: it should be mottled, the flesh firm, the skin smooth and elastic to the touch, and not flabby: there should be no impediment to the motion of either the arms or legs, they should move freely: the joints should be noted if they are swollen, if large or small: the epiphyses of the long bones should be carefully noted, and evidences of rickets determined, as this has an important bearing on various infantile diseases.

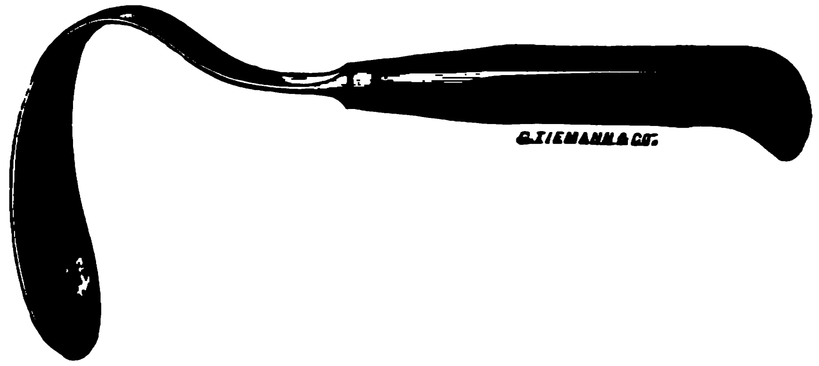

Fig. 7.—A Very Convenient Tongue Depressor is the One Shown in the Illustration.

I have previously called attention to the necessity of undressing a child for its proper examination. Fever which cannot be explained may have an eruption of scarlet fever on the body. This can only be detected by undressing and examining the infant.

X-RAY OR ROENTGEN RAYS.

The value of the x-rays as a diagnostic aid is beyond question. It is especially valuable in painful accidents to the extremities where swelling and inflammation prohibit manipulation of the parts. ***Foreign bodies*** when swallowed are easily located with the aid of the fluoroscope. I have frequently been able to trace coins and buttons that were swallowed, from the stomach into the intestines.

A case of this kind was referred to me by Dr. L. F. Haas. Two days after the coin had been swallowed, the round outline could plainly be seen, located in the ascending colon.

Displacement of the heart toward the right axilla by a malignant growth involving the left lung can be very plainly made out with the aid of a fluoroscope. An intubation tube that was pushed into the œsophagus by an inexperienced operator, was located by me in the intestine by this means. Experts with the Roentgen tube have frequently located cavities in the lungs and also effusions in the chest. Carl Beck, of New York, recognized as an expert, was the first to demonstrate gall-stones with the aid of the x-rays.

Difficulty in Making an X-ray Examination in Children.—I have frequently spent hours trying to get an x-ray picture of a child. The noise of the spark and the darkened room seem to frighten very young children. If it is vital that an x-ray examination be made or a picture be taken, an anæsthetic may be necessary.

In older children an x-ray examination will aid in establishing the diagnosis in congenital dislocation of the hip joint. (See illustration in chapter on "Congenital Dislocation of the Hip.")

CHAPTER V.

GENERAL HYGIENE OF THE INFANT.

HYGIENE OF THE MOUTH AND TEETH.

Mouth.—Care should be bestowed on the mouth and teeth. The newborn baby should receive an occasional washing of its mouth with a weak solution of boric acid and water. This should be done very carefully and gently, or the delicate floor or roof of the mouth will be denuded of its epithelium and invite infection.

Bednar directed attention to the presence of aphthæ due to traumatism. (See chapter on "Bednar's Aphthæ.")

The Teeth.—When teeth are present they should be kept clean. It is especially advisable to have the teeth cleaned with a weak antiseptic solution such as listerine and water once a day. Neglect of the teeth will result in caries and foul breath. A dentist should be consulted if there is the slightest evidence of decay. The necessity for healthy teeth is very apparent in infancy and childhood. A practical method of cleaning the teeth of children is to use a slice of lemon or lemon juice applied with cotton.

THE MANAGEMENT OF THE NAVEL (UMBILICUS).

THE UMBILICAL CORD.[1]

If the child is in a good condition and is not blue (cyanotic), and if the pulsations of the umbilical cord have ceased, then the cord can be tied about one or two inches from the child's body. If the child is feeble we can gain by waiting for a few moments as we admit oxygenated blood through the umbilical vessels into the child's body. The point to be remembered is "to tie the cord if the pulsations therein have almost ceased." This usually takes from two to five minutes.

Some authors, *e.g.*, Professor Epstein, advise making a gauze pouch resembling a small tobacco pouch to tie the cord. This can be easily sterilized by baking in an oven about thirty or forty minutes. Care must be taken that the heat is not too great or the gauze will be burnt.

Do Not Use Oil or Salves.—When salves or oils are used they exclude the air and prevent the drying of the umbilical cord, which is so desirable. In order, therefore, to admit a current of air through the gauze to the cord *nothing greasy should be used.* The best thing to use is arrowroot or cornstarch or a talcum powder containing 1 per cent. of salicylic acid.

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[1] Diseases of the umbilicus—hæmorrhages, etc.,—are described in Part II.

The following two prescriptions are recommended as drying powders:—

℞ Talcum	**100 grains.**
Acid salicylic	**1 grain.**

Mix and apply thoroughly every morning.

℞ Talcum	**100 grains.**
Boric acid	**1 grain.**

Use as above stated.

If the child's condition is normal and healthy action takes place, then the cord usually falls off in about five to ten days.

After-treatment.—The after-treatment consists in sprinkling one of the above-mentioned drying powders, and covering the region of the umbilicus with several dry layers of plain sterilized gauze, over which an abdominal binder should be placed.

An excellent powder is sold in the shops under the name of Velvet Skin Powder.[1] It contains the following ingredients:—

Boric acid	**1**	**gram.**
Lycopodium	**0.5**	**grain.**
Orris root	**7.5**	**grams.**
Boro-tannate of aluminium	**0.25**	**gram.**
Talcum	**q. s. ad 100**	**grams.**

Vernix Caseosa.

The child at birth is covered with vernix caseosa. It is Nature's lubricant to protect the infant from the change of temperature prior to and after birth.

It is advisable to lubricate the body with olive or sweet-oil. This will soften and remove the vernix caseosa. This can be continued daily until the cord has fallen off.

The First Bath of the New-born Baby.

The ease with which an infection can take place through the umbilical[2] vessels accounts for most authors advising *against the first bath being given until the umbilical cord has separated from the body.* After the cord has separated and there is no evidence of inflammation or suppuration in the region of the umbilicus, then the first bath may be given. This is usually about the end of the first week.

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[1] The above powder is made by Palisade Manufacturing Company, Yonkers, N. Y.

[2] For disease of the umbilicus read Part II, Chapter on "Umbilicus."

BATHING THE BABY.

The temperature of the bath for a new-born baby should be warmer than the baths given as the child's age progresses. It is advisable to bathe a new-born baby in water having a temperature between 95° and 100° F. To determine the temperature of a bath it is necessary to have a bath thermometer. One having a wooden casing is preferable. (See Fig. 8.)

We should never guess at the temperature of a bath. Sometimes a bath that feels very hot to a sensitive skin may not be as warm as we imagine, hence the rule should be , "depend on the thermometer." The temperature of the bath should be lowered or made cooler as the infant grows older.

The temperature can be lowered five degrees from month to month until the bath is given at a temperature of 75° F. This is a tepid bath which can be continued during both winter and summer months for the first year of life.

Additional Cleanliness.—It is self-understood that every infant requires additional sponge baths to keep its buttocks and genitals clean, especially so after each bowel movement. If a child is properly washed or sponged it is not necessary to overdo the use of soap.

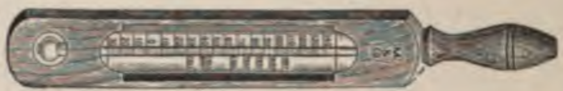

Fig. 8.—Bath Thermometer.

The Use of Soap.—Excessive use of soap will provoke eczema. Soap acts as an irritant to the skin if over-used. There are some bland soaps which, if used in moderation, will do good; thus, the ordinary olive-oil soap, commonly known as castile soap, or the ordinary glycerine soap found in drug stores, is very good. Medicated soaps are of no value for a new-born baby, unless some special form of soap is required in a skin disease.

After the Bath.—The child's body should be thoroughly dried and powdered, especially in the folds of the skin between the thighs, in the arm-pits, around the neck, the back, and the abdomen. We should use powder very liberally, as the dryer the skin is kept the less chance will there be for the development of an eczema.

Sensitive Skin.—If an infant's skin shows a tendency to be red and chafed then it is advisable to use no soap at all, but an ordinary bath or an oatmeal bath made in the following manner will be found advantageous:—

Oatmeal Bath.—*How to make the bath:* Take between two and three pounds of good oatmeal, and sew into a bag made of cheesecloth. Place the bag with the oatmeal in the infant's bathtub, containing one-half the quantity of water to be used for the bath. After the bag has soaked for about one-half hour, add enough water to bathe the child's body therein. The duration of the bath shall be about five to ten minutes. After the bath dry the body thoroughly and apply the following ointment wherever the skin is tender:—

℞ Calaminaris	5 parts.
Zinc ointment	50 parts.

Apply with a piece of clean gauze over the affected parts. Do not use the fingers for applying the salve.

When to Stop Bathing.—It is advisable not to bathe if an infant has an eczema or a very reddened skin, and it is a good rule to follow never to bathe if an eruption of the body is present, unless such eruption is due to an irritation applied to the skin. Turpentine, mustard, and camphorated oil when rubbed into the skin will cause an eruption resembling scarlet fever. Under such conditions the bath may be used; when fever appears the bath may be continued, providing there is no eruptive disease like measles or scarlet fever, and then even the baths may be given if the attending physician so desires. When children have a cough or during catarrhal manifestations, it may be advisable in some instances to discontinue the bath for a day or two. Great care should be used while bathing a child suffering with vulvo-vaginitis to avoid infecting the eyes.

CLOTHING.

In New York and similar climates children should be comfortably clad. The body *should never be overheated.* The trouble usually found is that children are coddled and their bodies overheated by an excess of flannels. I have frequently had occasion to treat eruptions similar to the lichen tropicus which was produced by an *excessive amount of clothing* and consequent perspiration.

The body should be well protected in winter, and very loose, light clothes should be worn in summer. No infant should be strapped tightly, but due allowance must be made for respiration and for the normal exercise of the infant, namely, by permitting freedom of the limbs. No pressure should be permitted on any portion of the body, so that the circulation is not impeded. Displaced organs can result from very tight-fitting bands.

The Feet.—The feet should always be protected. I do not approve of hardening infants by exposing their bare legs to the peculiarly changeable climate of our Atlantic coast. I have frequently found digestive disturbances which could be attributed to cold feet.

The usual shoe found in the shops for the new-born infant, as well as the first walking shoe, are simply ornaments and not practical shoes. It is advisable to devote at least enough care to have the shoes made on anatomical lines. The accompanying illustration (Fig. 9) shows the proper shape for the first walking shoe.

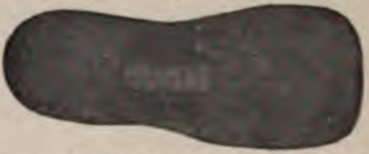

Fig. 9.—Proper Shaped Shoe for Infant.

The Abdominal Band.—The belly-band is a source of great anxiety to the mother. Its support is valuable for the umbilicus, when the child is troubled with constipation or diarrhœa. It is a valuable support for the abdominal muscles if the child is affected with whooping-cough. It is not necessary to wear the band as an abdominal support more than three months. Delicate infants, premature infants, or those suffering with gastro-intestinal disturbances may require a supporting bandage for a much longer time.

Night Clothing.—Due allowance must be made for seasonal changes, so that light clothing should be worn in summer and a heavier set in winter. Restlessness will frequently be induced by having the body too warm.

THE NURSERY.

To develop an infant we require fresh air and sunshine. We must only compare a flower deprived of sunlight and air to that which is developed under ordinary healthy surroundings. An infant should be given the best room in the house, with a southern exposure. The reverse is usually found; infants are put into the smallest room, as though they were in the way. The nursery should be cheerful and sunny, and have a temperature ranging between 66° and 72° F. At night, when the child is well covered, the temperature may be lowered to 60° F. without hurting the infant.

Ventilation.—This is one of the most important matters to be considered during the development of the infant. An infant should invariably be removed from the room in which it has slept, and the windows of the nursery should be opened both top and bottom. After proper ventilation the windows are closed and the infant may be brought back again. The nursery should be ventilated at least two or three times a day.

When to Take an Infant Out of Doors.—An infant one month old should be taken out into the fresh air in summer, sometimes sooner. It is understood that the first few times a child is taken out of doors, it should be taken into the sun, if possible, for one or two hours. On rainy days or when it snows I invariably insist on giving the infant air by throwing open the windows and dressing the child with coat and cap as though it were to be taken into the street. This can be done for half an hour in the morning and afternoon.

The Nursemaid.—The selection of a nurse is not an easy matter. That it is an important matter we can see when we consider cases of tuberculosis and syphilis that have been unquestionably transmitted by the nurse to the child. My rule is to exclude a nurse who suffers with catarrh or throat trouble. They are a constant menace to a healthy child. Specific rules should be given by the family physician to each nurse regarding the feeding, bathing, and general hygienic management. I invariably advise against nursemaids kissing children on the mouth. They should never be permitted to sleep in the same bed. I have known more than one case of urogenital discharge transmitted to a female infant in this manner. I prefer a nurse between 20 and 40 years of age, one that is quiet, mild mannered, and that does not "know everything." Experimental feeding, as is frequently tried, by that miserable creature known as the "experienced nurse," is responsible for more rickets and weak children than any other method of rearing children. It is the mother's duty to consult the physician at least once a month or oftener, regarding details of feeding, etc., and it is the *mother's place to instruct the nurse.* A mother who is dependent on a nurse will find that fact to be a detriment to her child.

Method of Heating.—An open-grate fire or a Franklin radiator afford the best means of heating. Our city apartments in New York are furnished with steam heat, and a great many have gas heating. These latter are the worst forms of heating and are responsible for more catarrhal affections of the air passages than anything else. I invariably advise the use of a kettle with steaming water to add moisture to a room in which a gas stove or steam radiator is found.

The air should be kept as fresh as possible; soiled diapers or soiled clothing should never be dried in the nursery. Smoking in the nursery should not be permitted, and kitchen odors should not be allowed to reach it.

Light at Night.—To insure proper repose there should be no light and no noise in the nursery. With modern conveniences, such as electricity, a small, green, glass bulb can be used when a light is necessary. A wax night candle will answer for all purposes at night if electric light cannot be used.

The Furniture.—The simpler the furniture the better. The ease with which infants and children contract measles, scarlet fever, and diphtheria shows the necessity for plain furniture and no useless overhangings. If the physician will explain to the mother that pathogenic bacteria will remain for months in carpets and rugs and tapestries, she will understand why simpler means are required. It is advisable, if possible, to have a hard wood floor which may be scrubbed thoroughly. All rugs should be aired daily, and it is safer to fumigate the same with formaline when occasion requires (see Fig. 10.)

The Bed and Pillow.—A cradle that can be rocked should never be used for a child. Nothing worse than a feather bed can be imagined; still I see them frequently. The best thing for an infant to sleep on is a hair mattress, and by all means a hair pillow.

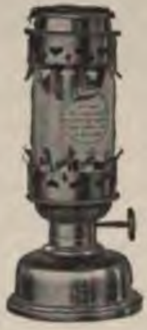

Fig. 10.—A Very Convenient Formaline Lamp is Schering's.

PROPER TRAINING.

From earliest infancy it is advisable to train the baby. It should be given the breast, and after it is through nursing or feeding from the bottle it should be laid in the crib. If this habit is commenced early, a regular habit of resting can be formed. If, on the other hand, we permit the infant to sleep next to its mother's breast, it will get into the habit of being fondled to sleep. Bad habits will compel the mother to be a slave to her child, and wise is she who will accept the honest, well-meant advice of the physician regarding regularity in habits.

Bowels.—An infant three months old can be put on the commode. The best time for the infant's bowels to move is after the morning bottle. Instruct the mother to place the child on the chair, and if the bowels do not move naturally, assist the same by injecting about two ounces of water to which a few spoonfuls of glycerine have been added. This will aid in directing the infant's attention to its bowels. If the mother will do this regularly every morning the infant will gradually learn to know for what purpose it is placed on the chair.

Bladder.—What is possible with the bowels can be accomplished with the bladder. If the mother or nurse will place the infant on a vessel every three or four hours, the infant will gradually learn to hold its urine until such time. The infant should be placed on the vessel immediately on awakening, be it night or day. Children invariably empty the bladder on awakening.

Hygiene of the Nervous System.—To develop an infant's brain the nervous system requires quiet but cheerful surroundings. Useless excitement is harmful. To take an infant and handle it like a toy is wrong. I have seen infants taken up from a sound sleep to display the "talent" that some one had taught them. Nothing is more harmful than to have the mother compel her infant to display various tricks during its feeding. While this may be a gratification to the friends, it certainly is detrimental to the infant's brain and nervous development.

EXERCISE. GYMNASTICS.

The infant's clothing should be loose enough to permit the infant to use its arms and legs freely. An infant gets exercise in its bath while kicking its legs and moving its arms. A cool sponge bath of the body chills the surface and causes the infant to draw long breaths; this expands the lungs and is the best form of pulmonary gymnastics.

Leaving children in their cribs without proper exercises has been the means of producing what some authors term "hospitalism." This is simply a wasted marasmic or atrophic condition of infants due to faulty hygiene. A child that is six months old should be placed on a large rug and permitted to roll or crawl at will. When infants are seven and eight months old, and desire to stand, they should be encouraged to do so. This grasping and other muscular efforts stimulate the circulation, besides giving tone to the muscles. Older children should be permitted to exercise, so that there is a symmetrical development of the body. Walking is the best out-of-door exercise. Older children should ride a bicycle, or ride horseback, or play ball. Swimming is a healthy exercise. Gymnastics, both in and out of doors, should always be encouraged. In rainy weather older children should have pulley weights, dumb-bells, or rowing machine for house exercise. When children do not develop properly and show weakness of their muscles, passive movements, aided by massage, will be serviceable until the child is strong enough to continue its own exercise. Healthy children should be encouraged to have out-of-door exercise regardless of the weather. It is self-understood that during storms children should be kept indoors. It is necessary to regulate the amount of exercise to the strength of the child. If fatigue or over-exhaustion are brought on by excessive exercise it will be found to be just as productive of harm as under-exercise.

PART II.

ABNORMALITIES AND DISEASES OF THE NEW-BORN.

CHAPTER I.

PREMATURE INFANTS.

An infant born before 280 days of intrauterine life is called premature. Some authors maintain that infants weighing less than 4 pounds should be considered premature. If the length of the body is less than 19 inches then we may suspect prematurity. The internal organs, especially the lungs, not being fully developed, we cannot expect normal functions. A premature infant does not cry but whines. There is muscular inertia. The circulation is very poor and there is a subnormal temperature ranging between 88° and 96° F.

Children born at six and a half months have grown up strong at last, although it is not often they survive if born before the seventh month. The great need of such a baby is heat, and the maternity hospitals employ an apparatus, called a *couveuse, brooder,* or *incubator,* especially devised to supply it.

For family use a *couveuse* may be bought at the instrument makers, or hired from some of them. This is perhaps better, as the apparatus is costly. With an increased degree of attention we may get along fairly well without it. If a premature baby is bathed at all after birth, the temperature of the water should be 105° F., and the greatest care should be taken, while drying, to see that the child is not chilled. It should be made very warm by swaddling it in raw cotton, head and all, leaving only the face exposed, wrapping it about with a blanket, and tying it around with a roller bandage. Hot-water bottles should be placed on each side of it as it lies thus wrapped up in its bed, and fresh ones substituted frequently. A very convenient method is to place the child in a baby's bathtub half-full of raw cotton, in which a number of hot bottles have been concealed.

The infant's only clothing consists of a diaper and a shirt. The room should be kept warm, and especially so when this human bundle is unwrapped for its bath. After bathing it should be rubbed with sweet-oil and rolled up again in fresh cotton. Often it is better to omit all bathing, and simply rub with the oil. These premature infants lose considerably more in proportion to their birth weight than babies at term. This is due to their immature digestive tract; also to the fact that they are almost always intensely jaundiced. They gain very slowly; if at the end of two or three weeks they have reached their birth-weight, they have done unusually well.

The incubator here described (see Fig. 11) is the one used at the Sloane Maternity Hospital. There is a great variety of these incubators, but the one made by the Kny-Scheerer Company in New York City will answer all requirements. Owing to its expense the manufacturers will lend an incubator for a nominal sum per month.

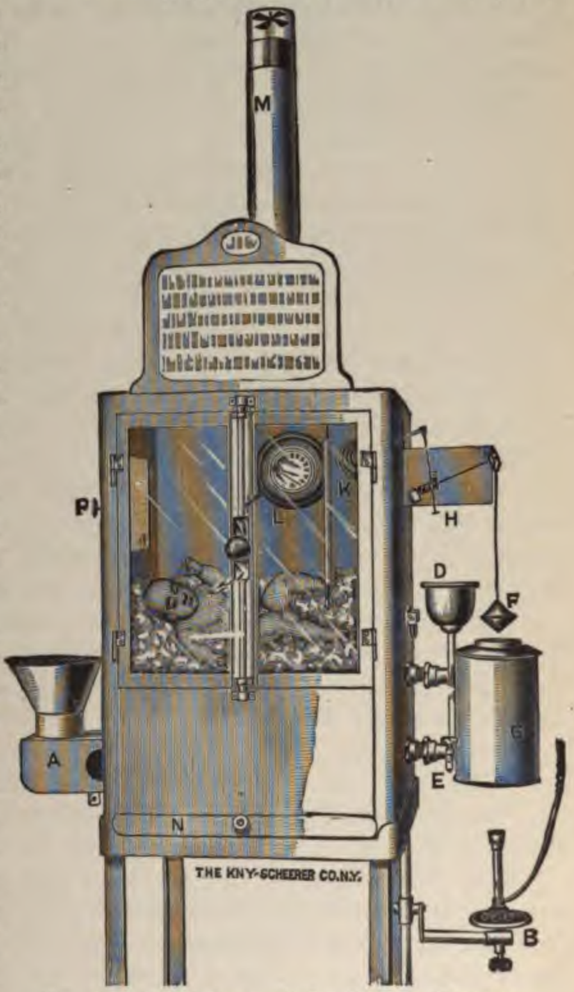

Fig. 11.—Incubator made by the Kny-Scheerer Company, New York.

The apparatus is constructed of steel, with glass doors and one glass window on the side for feeding purposes, etc. The heat generated in *C* communicates itself to the water-filled tubes *E* on the inside, maintaining a uniform temperature at any desired point by means of a spiral-thermo-regulator inside which is controlled by micrometer adjustment from outside. The hygrometer records the atmospheric conditions of the chamber. The air supplied to the infant is filtered through an absorbent-cotton filter in box *A;* this air can be taken from the room in which the apparatus is placed, or directly from the outside by means of simple tubes. The revolving wheel *M* in chimney indicates the perfect circulation of air. *B* is the gas-burner; *H* regulates the gas; *D* is the funnel through which tank *C* is filled; *L* is a hygrometer to indicate atmospheric conditions; *P* is a sliding window used in feeding the infant.

In some of the babies the color is poor from the beginning, and at any time they are liable to attacks of cyanosis. For these conditions a little slapping to cause a good cry or the administration of oxygen will dissipate the blueness. Often a few drops of brandy in water given every two or three hours will prevent further trouble. One must be very sure, however, that nothing has been aspirated into the larynx (Griffith).

A great danger in the care of these babies is their susceptibility to infections. The incubator itself is a great germ carrier and should be regularly disinfected. The weakness of the lungs and gastro-enteric tract makes the infant especially vulnerable. Unless the air is filtered dirt is carried in continuously; consequently, the streptococcus, staphylococcus, and pneumococcus are always present, seeking an avenue of entrance, through the skin in eczematous spots or in areas of irritation, at the navel, through the eyes, nose, mouth, larynx, lungs, stomach, and rectum, the bacteria can gain admission. To prevent infection the most careful cleansing is necessary, of both the incubator and the baby. Undoubtedly most of the deaths of our cases could be traced to this source.

A Danger of Incubators.—An infant placed in an incubator was found dead one morning, suffocated by vomited milk drawn into the lungs. To prevent this catastrophe Wormser suggests that infants should not be replaced in the incubator until a certain interval has elapsed after feeding. E. Wormser (*Centralblatt f. Gynækologie,* No. 38).

Finally, in the carrying out of the above essentials in the proper management of the premature infant, we require the most patient and painstaking attention on the part of the nurse, and upon her conscientiousness depends the chance of its survival.

RESULTS.

The statistics are taken from 2314 births which occurred at the Sloane Maternity Hospital.

Four hundred and ten of these babies were premature, but of these 74 were stillbirths, which include macerated fœtus and stillborn cases of placenta prævia, accidental hæmorrhage, eclampsia, and the like, leaving 336 for treatment.

Among these cases was a set of triplets, and there were 18 pairs of twins; 85 were treated as infants at term, and of these 4 died—a mortality of 4 $^1/_4$ per cent.; 145 were put in cotton, and of these 12 died—a mortality of 8 per cent. Some of this class should have been placed in the incubator, but for lack of room it was impossible; 106 were incubator babies.

These are divided into two classes:—

1. Those that died within 4 days after birth.
2. Those that lived longer than 4 days.

Twenty-nine of the incubator babies died within 4 days. All of these were more or less asphyxiated at birth; 9 were breech cases, and of these 5 were difficult extractions; 3 after an *accouchment forcé in placenta prævia.* The rest were vertex presentations, and of these 2 were forceps deliveries; 6 were under 7 months of uterine gestation; 22 were between 7 and 8 months, and 1, 8 $^{1}/_{4}$ months.

The etiology of the premature labor was an endometritis in 14; syphilis in 2; albuminuria in 1; placenta prævia in 3; accidental hæmorrhage in 1; persistent vomiting in 1; twin in 1; violence in 1, and in 4 the labor was induced. The largest baby weighed 5 $^{1}/_{8}$ pounds; the smallest 2 $^{7}/_{16}$ pounds. Only 5 infants lived over 24 hours; 24 were in such poor condition at birth that they survived only a few hours. In 16, autopsies were held, and in all of these there was marked atelectasis; in 7 there were hæmorrhages of some degree, either into the brain or into the serous membranes; in 2 the foramen ovale was still patent.

Seventy-seven incubator infants survived the first 4 days; 51 were children of primiparæ, 27 of whom were out of wedlock; 3 infants were under 7 months of gestation; 8 were over 8 months; 9 were breech presentations; 1 a transverse and the rest vertices; 2 were of triplets associated with albuminuria; 18 were in twin deliveries, associated with albuminuria or hydramnios. The cause of the premature labor was endometritis in 27; syphilis in 4; phthisis in 2; albuminuria in 7; accidental hæmorrhage in 1; placenta prævia in 1; in 2 the labor was induced for albuminuria and eclampsia; 1 was a Cæsarean section; another an ectopic gestation by a laparotomy; 12 were slightly asphyxiated at birth, 9 moderately so, and 5 deeply asphyxiated; 2, after one and one-half hours' work of resuscitation, were put in the incubator head downward, and their condition was so poor that they were not expected to live, but they left the hospital gaining in weight; 5 weighed less than 3 pounds; 38 between 3 and 4 pounds; 33 between 4 and 5 pounds; 1 over 5 pounds; the average weight was 3 $^{3}/_{4}$ pounds. During their incubator life 28 had one or more attacks of atelectasis. All but 10 were more or less jaundiced. The initial loss of the infants was from 1 to 17 $^{1}/_{2}$ ounces; the average was 7 ounces.

These figures are not quite correct, as the babies were weighed at different intervals, some on the fifth day, some on the seventh day, and some not until the fourteenth day.

The period of loss was from 5 to 22 days, the average 11 days; 10 lost steadily until death; 1 baby was in the incubator only 3 days, while another lived there 82 days. The average time was 19 days. Some were removed early to make room for others who needed the place more urgently.

Only 3 of the 77 cases vomited. The stools were normal in 32.

One was discharged from the hospital as early as the eleventh day; and others, also, too soon at their mothers' demand. One was 89 days old; the average was 24 days.

In 16, diluted breast-milk was supplemented at times, with a mixture of cows' milk and water, with Russian gelatine and lactose. In 10, a 1, 6, 0.33[1] modification was used. In all the rest diluted breast-milk was relied upon. Twenty-seven never nursed at the breast; of these 12 died. A few nursed as early as the third or fourth day two or three times daily; others not for three weeks, and 1 not till the sixty-eighth day. Of the 77, 13 died in the hospital—a mortality of 16 per cent. The cause of death was atelectasis and bronchitis in 7; acute asphyxia from a curd in the larynx in 1; syphilitic pneumonia in 1; cerebral hæmorrhage in 1; gastro-enteritis in 3, and a patent foramen ovale and ductus arteriosus in 1. The condition of 3 was poor at the time of discharge, fair in 24, and very good in 37; 32 were above their birth-weights, and 57 were gaining in weight. To letters written about January 1, 1900, no answer was obtained from 28. Thirteen were reported as having died; 1 of these lived 14 months; 1 lived 4 $^1/_2$ months; 3 lived 2 months; 6 lived 6 weeks; 1 only a month. Five of these died at the Nursery and Child's Hospital, and 2 died at Bellevue Hospital. They were bottle-fed, and the probable cause of death was gastro-enteritis.

Twenty-one were found to be alive and doing well. Some had nursed and the others were bottle-fed. The oldest baby was 22 months, and almost all were good, healthy children. One baby at 7 months weighed 16 pounds. It weighed 4 $^1/_{16}$ pounds at birth, and nursed from its mother after leaving the hospital. The ectopic and the Cæsarean babies were in beautiful condition.

TABLE NO. 6.

Incubators.	Tarnier. Per Cent.	Charles. Per Cent.	Sloane Hospital. Per Cent.	At the Sloane Hospital, Not Counting Those Which Died in a Few Hours. Per Cent.
Saved at 6 months	16	10		
Saved at 6½ months	36	20	22	66
Saved at 7 months	49	40	41	71
Saved at 7½ months	77	75	75	89
Saved at 8 months	88		70	91

METHOD OF FEEDING.

The size of the child precludes the taking of an ordinary nipple; hence, various measures have been tried, the most successful of which has been, according to the author's experience, feeding with Dr. Breck's feeder for premature infants (see Fig. 12). Feed at intervals of one hour, the quantity varying with the age of the infant.

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[1] Fat, 1; sugar, 6; proteids, 0.33.

A prematurely born baby is certainly doomed without proper food, and there are so many other factors to be considered during its life in an incubator, such as ventilation, its bodily warmth and cleanliness, that too much stress cannot be laid on the value of its food. *Without breast-milk,* therefore, I feel justified in saying: *I have yet to see the premature infant that will survive,* and hence I advise *procuring breast-milk,* containing no colostrum-corpuscles, but from a woman having a child anywhere between two weeks to several months old, and *diluting this breast-milk,* as stated above, with a solution of milk sugar or cane sugar.

Voorhees[1] says: "Regarding the care of premature babies in incubators, we have relied mainly on diluted breast-milk, and have only employed diluted cows' milk in weak proportions when it was impossible to obtain the former. In our opinion our results would have been much poorer without the help of mothers' milk."

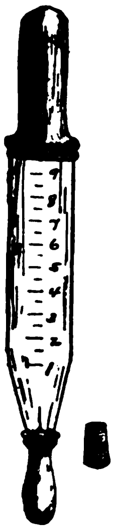

Fig. 12.—Dr. Breck's Feeder for Premature Babies. Can be made with a medicine dropper to which a nipple is attached.

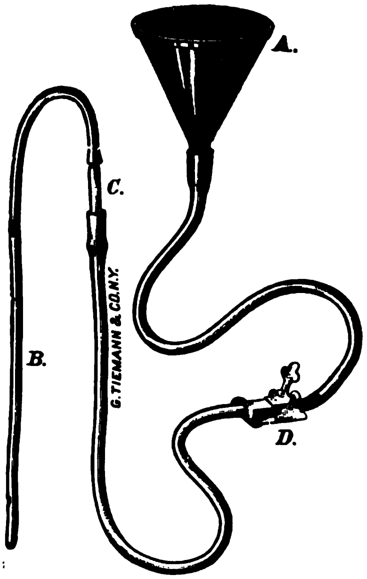

Fig. 13.—(*a*) Funnel. (*b*) Rubber Catheter. (*c*) Glass Connecting Tube. (*d*) Rubber Tube and Stopcock.

In rare instances, when infants are very weak and seem to doze and will not swallow, they should be fed with a No. 8 American (Tiemann & Co.) rubber catheter attached to a rubber tube about one foot in length and ending in a funnel. (See Fig. 13.)

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[1] Archives of Pediatrics, May, 1900.

With this funnel and catheter forced feeding, so called, gavage can be performed. With the infant lying flat on its back push the catheter slowly, but forcibly, as far against the pharynx as possible, and then from the pharynx into the œsophagus to the stomach. In all, from five to seven inches; rarely more will be necessary to reach the stomach. The milk properly diluted with an equal quantity of milk-sugar solution can then be allowed to flow into the stomach, and the catheter must then be quickly withdrawn. Such feeding should be repeated once in four, five, or six hours, depending on the requirements of the case.

Each infant is a law unto itself, hence no cast-iron rule can be laid down, but each case should be studied separately and its requirements met as indicated. I would urge the necessity of giving plain sterilized water to all infants living in an incubator. The increased temperature of its surroundings calls for it; so does the necessity of eliminating through the skin, bowels, and kidneys.

I have found in a premature infant, born at seven months, that 6 drachms were enough for one feeding, and this was well borne once in three hours. The food consisted of equal parts of breast-milk and milk-sugar water. This feeding was continued for one week, when the child cried very much, and on attempting to satisfy it, the infant swallowed 1½ ounces. We then alternated feedings by giving a large meal of 1½ ounces, followed by a small meal of 6 drachms, and fed in this manner every two hours until the child was three weeks old. We then gave 1½ ounces of food every two hours. The child's stool was quite good; it soiled from two to three napkins every day. When very restless we gave it from two to three teaspoonfuls of boiled water, which seemed to satisfy it.

Very small quantities of food should be used in gavage-feedings of the mouth or when feeding through the nose. No more than 4 to 6 drachms should be used, and thus we can feel our way. It is a good point to remember that the pharynx being very sensitive, the irritation of the tube passing into the stomach may provoke regurgitation of some of this food, and frequently vomiting will be produced.

ARTIFICIAL FEEDING.

Artificial feeding is not successful, as a rule, with premature infants. Rotch advises the laboratory method of feeding with the exact and low percentages as the most rational method, although in the same chapter he advises the use of breast-milk properly diluted at proper intervals.

For an infant premature at 28 weeks we should use:—

℞ Fat	1.00	
Sugar	3.00	
Proteids	0.50	Lactalbumin, 0.25. Caseinogen, 0.25.

Twenty-four meals, each 4cc. (ʒj). Pasteurize at 155° F. or 68° C. Reaction slightly alkaline. Feed every hour.

Considering the capacity of an infant's stomach at term to be one ounce, it is a good plan to recognize the deficiency in the development of not only the size and capacity of the stomach, but also its lack of digestive function. Hence my plan has been to commence feeding by giving two teaspoonfuls of milk diluted with two teaspoonfuls of sugar water; no limewater and no salt.

The Prognosis.—The prognosis depends on the assimilation and on the infant's general condition. Thus infants are apt to die suddenly from lack of vitality. The infant must be kept in a well-ventilated room having plenty of sunshine.

Weight.—The weight should be noted every day. The bowels must be watched. A premature infant should have at least two movements a day. It is advisable to take the baby cautiously out of the incubator. Crying is advisable to expand the lung and prevent atelectasis pulmonum. Changing the position of the infant is very important. Hypostasis in the lower portion of the lung can be prevented if this is done. Whenever possible a trained nurse should be placed in charge of an incubator baby during the day and a second nurse during the night. The nurse should be instructed regarding the importance of disinfecting her hands after handling the baby, before feeding it. An infection can be transmitted from the nurse's hands, if unclean, through the nipple to the infant's mouth. Such contamination may result in disease which may ultimately cost the life of the infant.

CHAPTER II.

PROPHYLAXIS AND TREATMENT OF THE EYES IN THE NEW-BORN.

The vaginal discharge of a pregnant woman contains pathogenic bacteria. This frequently gives rise to an infectious catarrh in the new-born. It is therefore important to treat the eye of the new-born baby with extreme care to prevent an infection which can produce serious results.

TREATMENT OF THE EYES IN THE NEW-BORN.

Ordinarily the eyes should be washed with a pledget of sterilized cotton dipped in plain sterile water or a 2 per cent. boric acid solution. The mouth and nose should be similarly treated. All cotton used for the hygiene of the mouth, nose, and eyes should be burned immediately after use.

Credé advises the use of a 1 per cent. solution of nitrate of silver. One drop (no more than one drop) is allowed to drop from a solid glass rod or a medicine dropper (Fig. 14) on the center of the cornea. Its object is to prevent the infant from acquiring ophthalmia neonatorum.

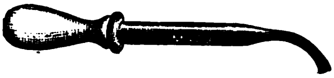

Fig. 14.

Garrigues[1] states that in lying-in asylums before this treatment was adopted, purulent ophthalmia was very prevalent.

Statistics show that one-half to two-thirds of those affected with blindness lost their sight from this cause.

When the frequency of the gonococcus in the vaginal secretions of women delivered in lying-in asylums is considered, then the wisdom of prophylaxis cannot be questioned.

Of late protargol (10 per cent. solution) has been substituted for the nitrate of silver solution. It is just as effective and less irritating.

Solution argyrol (20 per cent.) is very useful in the catarrhal affections of infants and children. I have seen very good results during my service at the Willard Parker Hospital with the same.[2]

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[1] Henry J. Garrigues: "Textbook of Obstetrics," 1902.

[2] See also Part X, "Diseases of the Eye."

CHAPTER III.

DISEASES AND MALFORMATIONS OF THE UMBILICUS.

GRANULOMA.

A MASS of fungus or exuberant granulations is frequently found in the umbilicus. Sometimes the granuloma resembles a large red bead. It is usually seen after the cord has separated. A discharge usually oozes. These granulations bleed very easily.

Treatment.—The application of a solid stick of nitrate of silver to thoroughly destroy the granulations is usually all that is required. If these granulations persist then the same can be removed with the aid of a sharp curette by simple scraping, after which a dusting powder like europhen should be used.

DIPHTHERITIC OMPHALITIS.

The new-born baby is occasionally infected with diphtheria. If there is an omphalitis the Klebs-Loeffler infection can easily be transmitted. The following case was seen by me in consultation:—

A child 4 years old suffered with diphtheria of the upper air passages, which finally spread to the larynx, necessitating intubation. This family lived in a crowded apartment. The mother gave birth to an infant five days later, and was herself infected with diphtheria of the vagina and vulva. Her new-born baby was about six days old when I first saw it. The umbilical cord had just sloughed away. The region of the umbilicus was highly inflamed and covered with thick pseudo-membranes. The child died on the eleventh day, of septicæmia. A culture taken showed Klebs-Loeffler bacilli. The physician that attended this family told me that the *nurse in charge of the older child with laryngeal diphtheria also nursed* the mother and the new-born baby. He believed that the infection was undoubtedly carried by the nurse.

Treatment.—Locally bichloride of mercury, 1 to 2000, applied constantly. Internally, antitoxin. (See chapter on "Diphtheria.") A case of this kind requires the same vigorous treatment as any other case of diphtheria.

THE DANGERS INCIDENT TO CARELESSNESS IN HANDLING THE NAVEL.

If through some accident the ligatures around the umbilical cord should slip, and blood oozes from the wound, fatal hæmorrhage can result. The attention of the physician should at once be directed to this condition. This can become a very serious matter if neglected, hence it is of the utmost importance to remedy it at once. The neglect of such things, besides the improper bandaging or uncleanliness in this region, is liable to cause not only convulsions, but blood poisoning and death.

SEPTIC OMPHALITIS.

An infant was seen by me, through the courtesy of Dr. S. Straus, in this city during the summer of 1902. *History,* as follows:—

It was the first child born; no previous miscarriage; family history excellent; no history of syphilis; labor was easy, and baby was born in natural manner. The mother was in excellent health; had milk in both breasts; normal temperature. Asepsis was thoroughly carried out. The infant had a temperature of 103° F. in the rectum, slight gastroenteric complication, greenish, colicky stools; the umbilicus was inflamed and excoriated; slight evidence of pus.

Diagnosis.—Septic omphalitis due, probably, to infection by the nurse with unclean hands while dressing the umbilicus.

Treatment.—Strict asepsis to be followed. The umbilicus to be washed with 1 to 2000 bichloride of mercury. Sterile gauze and aristol or some drying powder applied. The stomach and bowels were cleansed with calomel, and the infant fed every two hours at its mother's breast. The child made an excellent recovery in about four or five days.

MECKEL'S DIVERTICULUM.

A condition which may at first simulate umbilical polypus, and for which umbilical polypus may be a symptom, is the persistence of a Meckel

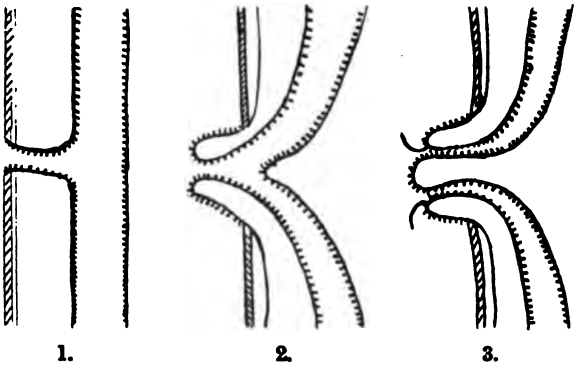

Fig. 15.—Diagram Illustrating the Effects of the Persistence of the Omphalomesenteric Duct and the Formation of the So-called Diverticulum Tumor (Riesman).

1. The omphalomesenteric duct shown as an opening leading from the umbilicus to the ilium.

2. Showing a small portion of the proximal intestinal wall. This may happen in a constipated child, while straining at stool. The same condition may occur during a paroxysm of whooping-cough.

3. The tumor is much larger, frequently sausage-shaped. It is irreducible.

diverticulum. This consists of the persistence of a piece of intestine, usually patent, connecting the small intestine with the umbilicus. It represents a vitelline duct that failed to atrophy when the placental circulation became established, and betrays its presence by an escape of fæces from the umbilicus. It is rare malformation (Rotch).

CONGENITAL OBLITERATION OF THE BILE-DUCTS.

This condition has been carefully studied by John Thomson, of Edinburgh. He has tabulated his studies in his book on "Congenital Obliteration of the Bile-ducts," 1892.

Etiology.—There can be no doubt that various malformations of the liver and bile-ducts do occur which are certainly of this nature. For example, congenital absence of the gall-bladder has been frequently described, and some of the cases were due to arrest of development, although many were probably of inflammatory origin. Wenzel Gruber has published a case in which a forked cystic duct was found, and Konitzky has described another in which the common duct had an unusually long and curved course, and opened into the middle of the horizontal portion of the duodenum, its lumen being narrowed. O. Witzel also has published notes of an infant born with a large number of congenital abnormalities, in whom, in addition to hemicephalus, situs viscerum inversus, six fingers on each hand, etc., there was a cystic condition of the liver and complete impermeability of both the cystic and common ducts. Other developmental defects have been observed, namely, in Heschl's absence of the bile-ducts in the liver-tissue, and in Professor Simpson's want of the spigelian and quadrate lobes.

The frequency with which this exceedingly rare condition affects several members of the same family is very strongly in favor of this view, and, indeed, it seems difficult to explain it otherwise. It has been suggested that this reappearance of the disease in the same family might be explained by supposing a common syphilitic taint. This suggestion, however, cannot be accepted, for we never find a tendency for an extremely rare manifestation of syphilis to recur four or five times in a family without any of the common symptoms of that disease being present at the same time.

Pathology.—The liver is usually found much enlarged, of a very tough consistency—due to biliary cirrhosis—and of a dark green color, owing to the presence of numerous masses of inspissated bile in the small bile-ducts. In the great majority of cases there is complete obliteration of some part or parts of the hepatic, common or cystic ducts, or of the gall-bladder, while with very few exceptions, implication of the blood-vessels or other tubes in the neighborhood is conspicuous by its absence.

Pathology of the Lesion of the Ducts.—The lesion has been ascribed to three different morbid processes, either acting separately or in combination, namely:—

1. *Peritonitis and its results,* acting on the ducts from outside, and either compressing them or being a source of inflammatory action, which spreads afterward to their walls.
2. *An inflammatory or other lesion of the ducts themselves.*
3. *An arrest or defect of development.*

And further, various predisposing causes have been described as accounting for these morbid processes, namely: —

1. *Congenital syphilis.*
2. *Digestive disturbance on the part of the parents.*
3. *Injuries or exposure to cold,* either of the mother or child.
4. *Erysipelas* of the child.

Symptoms.—Such children are jaundiced at birth or they become so within the first week or two of life; otherwise they are healthy and well-nourished. In some cases there is meconium followed by colorless motions; in others the fæces are devoid of color from the very first. The urine is deeply bile-stained. The jaundice is of a dark greenish tinge, and lasts till death, and the motions remain colorless. A certain proportion of the children die from umbilical hæmorrhage within the first fortnight, and, of those who survive this period, a large number suffer from spontaneous hæmorrhage from other situations. The liver steadily enlarges, and the spleen also. After living some months the children become more or less emaciated. Spasms often supervene, and death ensues in the end in a state of exhaustion from some trifling intercurrent disease.

CHAPTER IV.

HÆMORRHAGIC DISEASES OF THE NEW-BORN.

SPONTANEOUS HÆMORRHAGE.

THE occurrence of spontaneous hæmorrhages is one of the most characteristic clinical features in these cases. In the cases collected by Thomson, in 21 out of the 50—that is, in almost half of the cases which lived more than a few days—the fact of hæmorrhages having occurred from some part of the body is noted; and in all probability it may have occurred in some of the others also, although not mentioned, as the records of many of them are so meager.

The situations of the hæmorrhages mentioned in Thomson's collection are as follows:—

TABLE NO. 7.

Subcutaneous	in 7 of the cases.
Subconjunctival	in 1 of the cases.
Umbilical	in 6 of the cases.
From nose	in 2 of the cases.
Vomited	in 4 of the cases.
From bowel	in 8 of the cases.
From mouth	in 1 of the cases.
From lung	in 1 of the cases.
Into gall-bladder	in 1 of the cases.
From leech-bite (excessive)	in 1 of the cases.

A tendency to bleed is found in many children. In the preceding chapter I have described hæmorrhage as a symptom of congenital obliteration of the bile-ducts.[1] I have also described a very serious hæmorrhage in a case of congenital syphilis (see chapter on "Syphilis") which ended fatally. Direct infection through the umbilical vessels is a frequent cause of pyæmia, and this same can result in hæmorrhage.

Etiology.—Ritter[2] studied 190 cases. Of these 24 were associated with sepsis. Kilham and Mercelis[3] describe hæmorrhages in 10 cases out of 54. It seemed that these were all due to one and the same pyogenic infection.

Gaertner[4] describes a short bacillus which he isolated from two cases resembling the colon bacillus. When the same was injected into the peritoneum of animals, a disease was produced accompanied by hæmorrhage similar to that seen in the new-born. Holt describes a case in which cultures were taken by Dr. [illegible] from which a bacillus resembling that described by [illegible] was isolated.

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[1] Read article on "Hæmorrhages in Congenital Obliteration of the Bile-duct," page 35.

[2] Oest. Jahrbuch für Pediatrik, 1871, p. 127.

[3] Archives of Pediatrics, March, 1899.

[4] Archiv fur Kinderheilkunde, 1895.

Pathology.—Small or large extravasations of blood may be found upon the various internal organs affected. The brain, the thymus gland, the stomach, [illegible] the pericardium, the pleura, or peritoneum may have ecchymoses upon their surface. A frequent source of hæmorrhage is the [illegible] stomach and intestinal ulcers are by no means rare.

Symptoms.—The first symptom noticed is the presence of blood. This may be present in [illegible] in the stool, or in the urine. There may be [illegible] from the umbilicus. The bleeding does not [illegible]. The infant is usually very anæmic. The [illegible]. The body is emaciated. The temperature fluctuates, [illegible] it may be very high. The course of the disease [illegible] the bleeding usually ceases in a few days.

UMBILICAL HÆMORRHAGE.

[illegible] of the ligature around the umbilical cord or traumatism [illegible] a slight oozing. These oozings are very easily [illegible] of a proper fitting ligature. When, however, a spontaneous [illegible] occurs it may be impossible to arrest the same with ordinary [illegible]. In these cases the hæmorrhage occurs without previous [illegible] the umbilicus has been perfectly normal for a [illegible] hæmorrhage. Some authors state that it may be [illegible] hours.

GASTRO-INTESTINAL HÆMORRHAGE (MELÆNA).

Dark [illegible] stools are the usual symptom of melæna. The [illegible] of blood. A crucial test for the presence [illegible] presence of blood corpuscles is the [illegible]. Normally [illegible] contain blood. Another symptom is the vomiting of dark-brown [illegible]; occasionally bright red blood may be present.

Hæmorrhages of the mouth and nose are generally due to syphilis, although ulcerative conditions may cause local hæmorrhage. When pemphigus or [illegible] is present, hæmorrhages frequently occur. Hæmorrhage from the female genital organs may occur as well as from any other part of the body. They are usually associated with catarrhal inflammation of those parts.

Diagnosis.—This is usually very easy, especially if the bleeding is superficial. The diagnosis is difficult when an obscure place like the intestine is the source of the hæmorrhage. The microscope will usually aid in establishing a diagnosis of blood in the excreta. When the bleeding is confined to the mouth and nose, syphilis should be suspected.

Prognosis.—A careful prognosis should always be given, although the disease is not necessarily fatal. Townsend studied 709 cases and recorded a mortality of 79 per cent.

A male infant, six days old, was seen by me through the courtesy of Dr. A. Goldwater. The child had vomited several times. The vomit contained blood of a bright scarlet color. The stool had been yellowish, but now is black and tarry. There was a slight oozing of blood from the umbilicus. When I applied some absorbent cotton to the umbilical stump, bright scarlet blood was seen. The infant was well nourished and was nursed by its mother. The diagnosis of melæna neonatorum was made by the attending physician and I agreed in the diagnosis. The treatment consisted in the application of the solid stick of nitrate of silver to the umbilicus, and strict aseptic dressing. The hæmorrhages were probably due to pyogenic invasion.

Treatment.—Umbilical hæmorrhage can best be controlled, as above cited, by the application of a solid stick of nitrate of silver followed by a dusting powder such as:—

℞ Europhen,
Alum usta, aa, ʒij, or 8.0.
Sig.: Dust over the umbilicus.

For the control of intestinal hæmorrhage astringent injections are not to be relied upon. The suprarenal extract is a very good hæmostatic. I have frequently used very small doses of hydrastine hydrochlorate, $^1/_{50}$ to $^1/_{100}$ grain, three times a day, or $^1/_4$ to $^1/_2$ grain suprarenal extract, repeated every hour.

CHAPTER V.

INJURIES IN THE NEW-BORN.

FRACTURES.

TRAUMATISM during labor is the cause of most fractures in the new-born baby. A predisposition may exist, due to defective ossification. When the skeleton is not properly developed, then a separation of the epiphyses of the long bones rather than an actual solution of continuity of the diapheses occurs (Ballantyne).

This author also doubts the osteomalacic nature of fractures. Antenatal fragility seems to exist by direct heredity. Griffith reports seventeen fractures occurring in one case[1] during the first two years of an infant's life. Thus we can see that there must be some other factor at work permitting recurring fractures, rather than invariably traumatism.

It is true that syphilis has frequently been given as a possible cause for a weak-boned skeleton.

Brittle bones have been attributed to rickets. Prenatal disease on the part of the infant or its mother is frequently the cause of fracture. Linck[2] describes a case of an infant that was born in little more than one pain. In this case there was found over thirty fractures in the limbs and ribs.

Most of the fractures seen are of the "green-stick" variety. The prognosis in these cases is usually good, unless some complication appears.

The following case was seen by me in consultation with Dr. A. S. Bienenstock, of New York:—

An infant two days old had a fracture of the humerus. The seat of the fracture was in the center of the bone, and not near the epiphysis.

Mother's History.—The mother of the infant suffered with diabetes for the previous eight years, having between 4 and 4.5 per cent. of sugar. During the latter months of pregnancy she was in a subnormal condition. The labor was dry, and quite some skill was required to deliver the infant. The mother had no breast-milk, so artificial feeding was resorted to.

As this was in midsummer the infant soon became dyspeptic and later developed entero-colitis. At the seat of the fracture callus could be felt several days after I first saw this infant. Death resulted from summer complaint.

OBSTETRICAL PARALYSIS (ERB'S PARALYSIS OR BIRTH PALSY).

This condition may be seen soon after birth, or it may not be noticed for several days after that event. It is a peripheral paralysis and usually involves the deltoid, biceps, brachialis anticus, supraspinatus, infraspinatus, and supinator longus muscles. It may also involve the extensor muscles of the wrist.

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[1] American Journal of the Medical Sciences, Chap. CXIII, p. 426, 1897.

[2] Arch. of Gynæk., xxx, 264, 1887.

Symptoms.—The arm hangs limp at the side of the body. The position is governed by gravitation. The forearm is extended and pronated, and the wrist and fingers flexed. Movement does not cause pain. The reaction of degeneration can be demonstrated when the paralyzed muscles are examined with the electric current. Such examinations are very difficult in infants having a thick layer of fat. At times very powerful currents are necessary, thus provoking pain. In making an electrical test, the normal arm should always be compared with the affected arm.

Erb demonstrated the fact that "it is possible by a careful examination to find a spot two centimeters above the clavicle, back of the outer edge of the sternomastoid muscle, corresponding to the point of emergence of the sixth cervical nerve between the scaleni, at which point irritation by the faradic current will produce a contraction in the deltoid, biceps, brachialis anticus, and supinator longus muscles; and if the irritation be increased, the extensors of the wrist will also contract. Pressure upon this particular region is often made during delivery, either by the clavicle, or by forceps, or by the fingers of the obstetrician. This is more common when there is a breech presentation and the after-coming head is extracted in the common method. The index and middle fingers of the left hand being open like a fork over the shoulders of the child, traction is commonly made upon the shoulders, and the pressure of the obstetrician's finger in the neck often produces injury of the plexus. In some cases injury of the plexus is produced by attempts to bring down the hand or arm in breech presentations, or to replace these when the head presents. Forceps applications in an awkward position may also produce this injury."

Prognosis.—This depends on the time when the treatment is commenced. As a rule paralysis of the upper arm type remains three or four years. In a case of mine seen recently the paralysis remained until the child was 5 years old. When the faradic current is applied and the muscles respond, then the prognosis is good; if there is no response, a cautious prognosis should be given.

Treatment.—The arm should be supported with a sling. Massage aided by a faradic current is sometimes beneficial. In severe cases it is better to use the galvanic current, using the mildest current that will produce contraction of the muscles. If the child is old enough to be instructed, gymnastics should be tried at home daily. Strychnine may be given three times a day.

CHAPTER VI.

ASPHYXIA NEONATORUM (APPARENT DEATH OF THE NEW-BORN).

The center and regulator of the respiratory movements is located in the medulla oblongata. From it also is sent the motor impulse which gives rise to the first act of respiration.

The activity of this center is believed to be augmented by the condition of the venosity of the blood; therefore, all interruptions to placental respiration—for instance the premature detachment of that organ or the compression of the cord—and all obstacles to the introduction of air into the trachea, such as mucus or blood, will be attended with violent motor impulses: first, efforts to breathe, and later, convulsive movements producing death (Boisliniere).

There are two forms of this condition usually observed: first, the apoplectic form called by older writers *livida,* and second, the anæmic form called by older writers *pallida.* In the apoplectic form there is a bluish discoloration of the skin, a prominence and injection of the conjunctivæ, and a swollen state of the face and lips. The cardiac pulsations are generally strong, and the cord is distended with blood. In the anæmic form the child has a deadly pallor; the lips and fingers are pale, the body limp, and muscles relaxed. The heart's action is inaudible, presenting the condition known as asystole. Duvergie, in studying the asphyxia of adults, noted that when people were removed *shortly after* an embankment of earth had buried them, they presented a turgescence of the face, a violet hue of the skin, and frequent and regular pulsations of the heart.

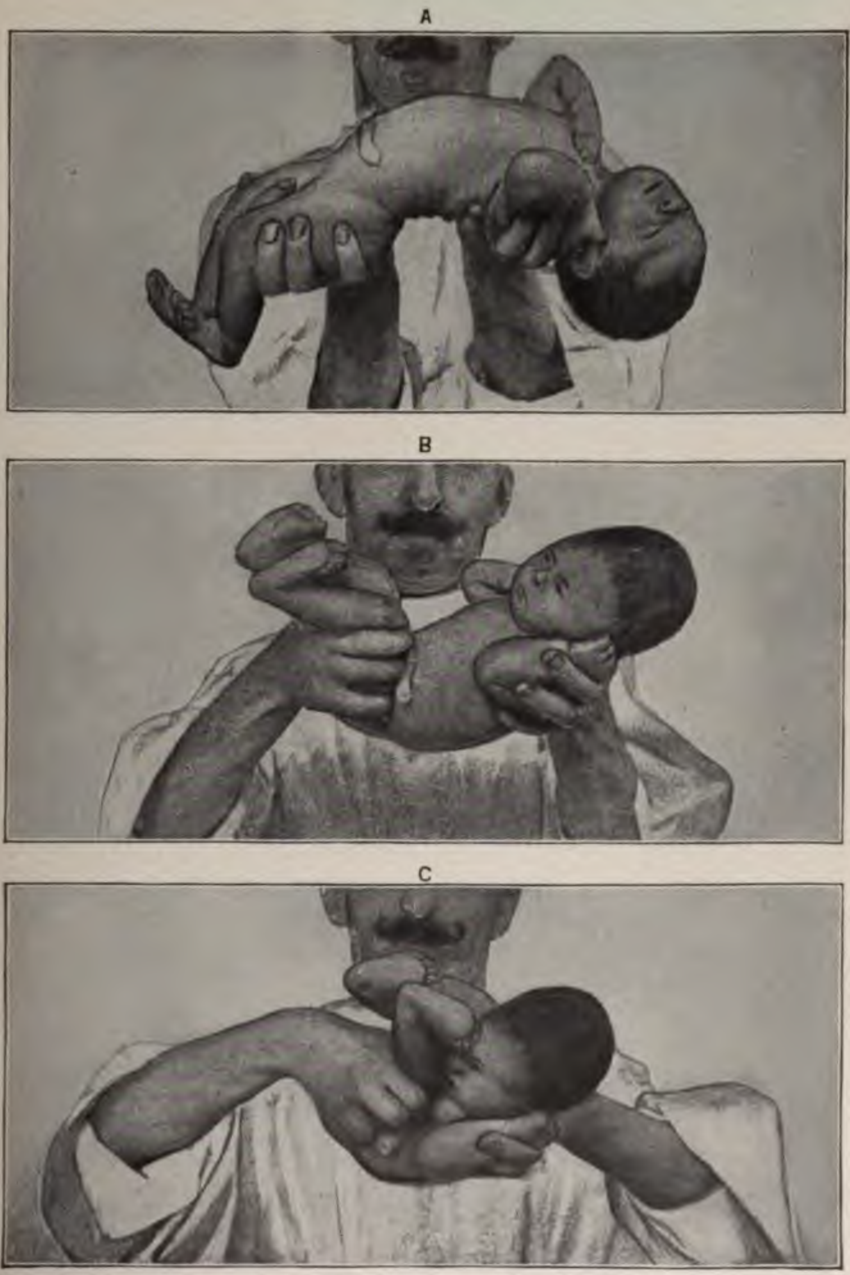
When they were found *some time after* an embankment of earth had buried them, they presented a deathly pallor of the skin, and the heart sounds were usually inaudible or very feeble. Thus it is apparent that the above conditions of asphyxia present, first, a *mild;* and then a *severe* type.

CAUSES.

The main causes of asphyxia are due to:—

1. Compression of the cord in a natural way.
2. Premature detachment of the placenta.
3. Forced rotation of the head in difficult forceps application or great contraction of the uterus in head-last cases, thus rendering the vessels of the uterus impermeable to blood and suspending the placental respiration. Another cause of asphyxia is shortness of the cord from its encircling the neck tightly after the head is born. The child's face in this condition be-

PLATE II



The Byrd-Dew Method of Artificial Respiration. *A*, Extension. *B*, Semi-flexion. *C*, Complete flexion. (Grandin & Jarman.)

comes turgid and blue, and unless relieved the child will die. The promptest treatment consists in cutting the cord above the child's head and delivering the infant's body as quickly as possible. Boisliniere advises the above method even at the risk of fracturing a humerus.

SIGN FOR DISTINGUISHING THE STILLBORN FROM THE DEAD.

Bedford Brown says that the best means for distinguishing the stillborn from the dead is to be found in the temperature. If the temperature keeps near the normal, we must not cease our efforts at resuscitation, even if the complete suspension of cardiac and respiratory action has lasted for twenty minutes or more; but if the temperature of the child suddenly falls 10, 15, or 20 degrees below the normal, then the case is hopeless. Another sign is the state of the pupil: in the dead the pupil is widely dilated, in the stillborn it is but little, if at all relaxed (*Therap. Gaz.,* Vol. XXXI, No. 6). The method consists in injecting into each arm five drops of whisky with one drop of tincture of belladonna. If the infant is only stillborn, the nervous and circulatory system respond quickly. If there is no response or only a very feeble one, warm sterilized water is injected under the skin (a drachm or two) and also about two drachms with a drop of aromatic spirits of ammonia, into the intestines. After this dry heat is applied. If these measures fail to produce a reaction, it is a fair test of the absence of vitality.

Treatment.—If the child presents a livid condition and is apparently apoplectic with the cord pulsating strongly, *then cut the cord* as soon as possible and allow at least an ounce of blood to escape. Sometimes it is necessary to cut the cord in several places. If bleeding does not ensue rapidly, then the cord should be severed and placed in warm water at a temperature of 105° to 110° F. This will usually stimulate the flow of blood.

When the child is born in a pallid condition and *feels cold, then the cord should not be cut* until all pulsations therein have ceased. It is in this condition that it will be so important to rapidly cleanse the mouth, nose, and larynx of mucus and blood. Some authors advise mouth-to-mouth suction or suction made through a soft rubber catheter placed in the larynx, but these are usually preliminary means, and success will only follow methodical application of artificial respiration.

Byrd's method is very simple. It can be conducted without rough handling, a matter of vital importance. The child's body rests on its back and is supported on the palm surfaces of the physician's hands. The physician, by elevating and lowering his hands, can produce inspiration and expiration in a rapid and efficient manner. This method is well worth trying. An important point to remember is to pull the tongue forward; for this purpose an artery clamp will serve in an emergency, if the physician does not have Laborde's forceps for traction on the tongue.

Laborde advises rhythmical traction upon the tongue eight or ten times a minute. This is a valuable method and can be used while the child is immersed in hot water. Thus the benefit of the stimulus on the tongue will be apparent while the hot bath is used.

Hypodermics of strychnine, $^1/_{100}$ of a grain, combined with 5 or 10 minims of whisky, may be indicated. Flushing the colon with a pint or more of water, temperature 110° or 115° F.; to which a half-drachm of alcohol has been added, may also aid in stimulating the circulatory and the respiratory tract. It is advisable to persevere for some time with the above method of resuscitation, even though we may be successful. It frequently happens that new-born infants will respond to active treatment and show signs of life, but we must continue for some time, or the respirations will cease and the infant may die.

A valuable means of restoring suspended animation consists in immersing the new-born infant, first into very warm water, and then into cold water. Alternate from hot to cold water every ten or fifteen seconds.

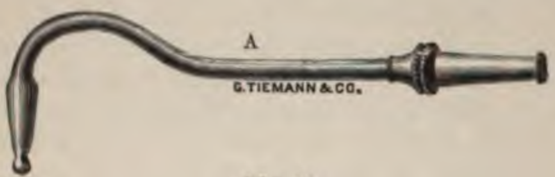


Fig. 16.

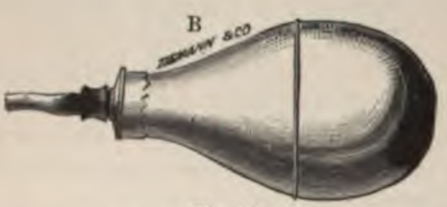


Fig. 17.

Ribemont's Tube for Inflating the Lungs.

INFLATION OF THE LUNGS.

This method is sometimes useful when other means fail. Some authors advise the mouth-to-mouth method. This consists in filling the cheeks with fresh air and then blowing the same into the infant's mouth. It can also be done by introducing a catheter into the infant's larynx. While the mouth-to-mouth method is simpler, it is not always a sure way of inflating the lungs. Quite frequently the air will be blown from the mouth, through the pharynx, into the stomach. To avoid the latter, the head should be thrown backward, and compression made over the epigastrium. If the nose is closed air is less likely to enter the stomach.

Mouth-to-mouth insufflation of air is not devoid of danger. Reich reported a case of tuberculous meningitis due to attempts at reanimation by a tuberculous midwife. The Ribemont laryngeal tube is much safer.

INTRODUCING A CATHETER INTO THE LARYNX.

A soft flexible catheter is more preferable than a stiff catheter, but this requires experience, and is not an easy matter in unskilled hands.

Ribemont's tube (Figs. 16 and 17) is the best instrument for inflating the lungs. It is inserted like an intubation tube. It serves two purposes:—

1. Forcing air into the lungs.
2. The aspiration of mucus from the trachea or bronchi.

Great care should be used with any and all methods. No force is necessary.

CHAPTER VII.

FŒTAL ICHTHYOSIS.

This condition is described by Ballantyne, Kyber, Wassmuth, and Carbone as a skin disease of the fœtus most probably developed about the fourth month of intrauterine life. It consists of horny epidermic plates over the whole surface of the body, separated from each other by fissures and furrows, associated with certain deformities of the mouth, nose, eyes, ears, and extremities, and leading to the death of the infant very soon after birth.

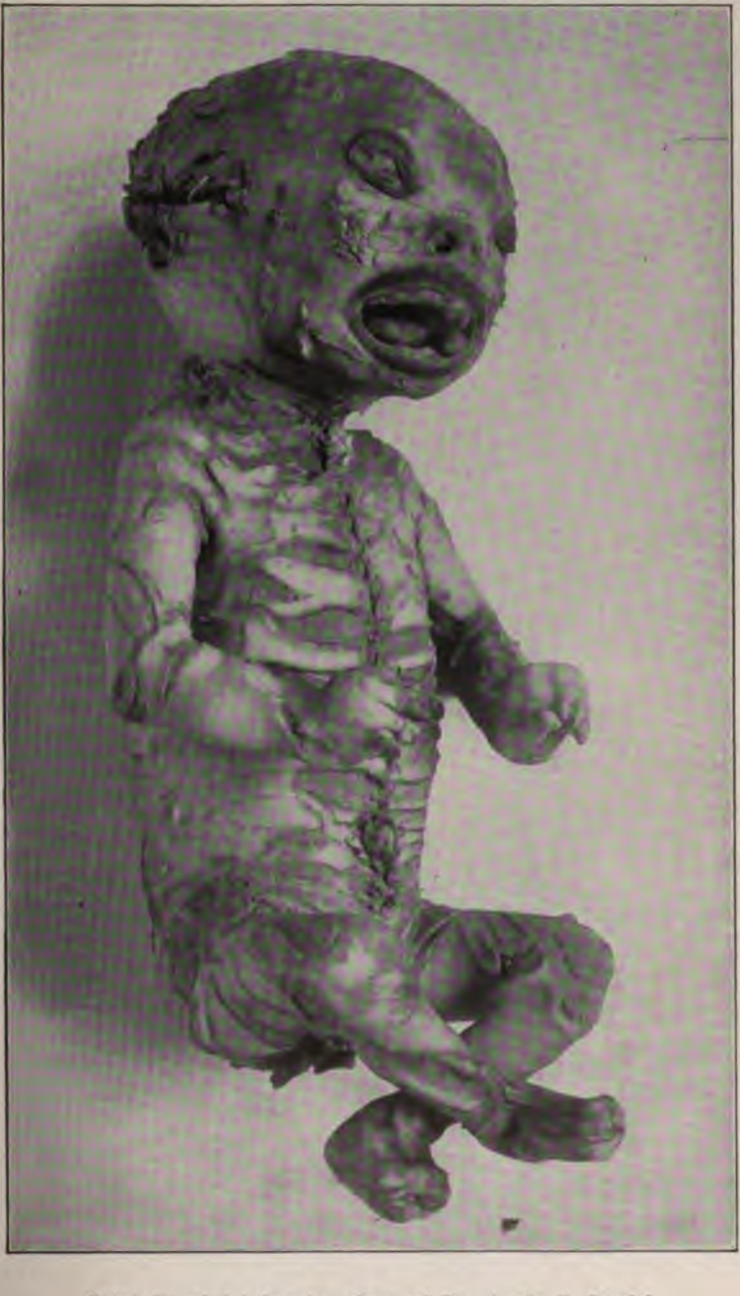
It is a rare condition, as only 42 cases could be found in the whole literature up to the year 1895. For the following case I am indebted to Dr. A. S. Daniel:—

Clinical History.—This case was first seen five hours after birth. The child had passed urine and meconium, cried continuously, sleep was impossible. The slightest jar of the crib or exposure to the air increased the crying. The respiration was irregular, the surface of the body cold. The child swallowed with difficulty and was fed with the aid of a medicine dropper. The child died suddenly twenty-four hours after birth. The temperature taken soon after birth was 103° F.

Description of the Child.—There was no resemblance between the child and a human being or any living thing. The tongue was the only part of the body that seemed capable of motion. The body presents the appearance of having been in an integument much too small for the skeleton, and Nature in its growth had so stretched the skin that it has the appearance of being torn in some places. Where it is torn through, a purple-covered slit appears, where torn partly through, a yellowish colored fissure remains. There is no uniformity of arrangement of the fissures. Fewer are found on the back, and those on the extremities are more shallow. The color of the fissure, a purplish red, is in marked contrast to the color of the skin. In a few places bright blood is found, as if the break were of recent origin. The whole body is cold and rigid. The scalp is divided into fissures and numerous irregular conical projections, varying in size. A few thin hairs are found on the lateral surface of the scalp. The external ears are replaced by conical projections. The palpebral fissures are filled with purplish-red masses; deep down in the sockets, eyeballs can be distinguished. The nose is flattened and is identified by the widely-opened nostrils. The mouth is open, showing a non-hypertrophied tongue. The lips are of a purplish-red color. The mouth measures 5 centimeters in length. Circumference of head, 36.5 centimeters; glabella to occiput, 18.5 centimeters; ear to ear, 15.5 centimeters. The neck is short. Anteriorally a fissure extends from the neck to the umbilicus, 2 centimeters in width. From this fissure, ridges of yellow skin and purple fissures extend toward the axillæ; they are of irregular size and depth.

The extremities are rigid and in the fœtal position. The arms can be raised only at right angles with the body. They cannot be extended at the elbow. The

PLATE III



Fatal Fœtal Ichthyosis. Case of Dr. Annie S. Daniel.

hands are thickened and the fingers are rudimentary. The legs are crossed. The motion at the hip and knee joint is very imperfect. The toes are rudimentary.

The median raphe in the scrotum is faintly marked; testicles are not descended. The penis is $^1/_2$ centimeter in length. The anus is open. The length of the fœtus is 42 centimeters, and its weight is 4 pounds 13 ounces. In this case it was impossible to find any clinical cause for the disease.

Of the cause of fœtal ichthyosis practically nothing is known. That it is not a fatal disease *in utero* is demonstrated by the fact that only one case thus far has been stillborn.

CHAPTER VIII.

INFLAMMATORY AND NON-INFLAMMATORY CONDITIONS.

ICTERUS NEONATORUM.

THIS form of icterus is frequently designated as a physiological condition. It usually begins on the second or third day after birth, and may continue for a week or even a month. Henoch reports a case of icterus brought to his clinic, which lasted five weeks and ended fatally. The majority of text-books describe this condition as a mild disease and give a good prognosis. There are many theories as to the causes leading up to this condition. The hæmatogenic theory maintains that a disintegration of red corpuscles takes place. This liberates the hæmoglobin, giving rise to the yellowish pigmentation.

Racchi, of Naples, disproved the correctness of this theory by a series of blood counts which he reported at the International Medical Congress held at Rome in 1895.

"We can scarcely believe that the red corpuscles simply go to pieces in the blood, and that the products of such disintegration, floating freely about or temporarily lodged in the tissues, give rise to the yellow color. It is far more in accordance with the workings of the living organism to suppose that the disintegration takes place in some organ, *e.g.*, liver or spleen, and if the products thereof are floating about, it is after passing such organ and on their way to final elimination."

Infant F. J. was seen by me when three days old. Had greenish stools containing mucus, and appeared colicky and cried considerably. No vomiting. There was a universal yellowish pigment of the body; jaundice well marked; gums were yellowish; conjunctival mucous membrane showed yellowish pigmentation. The umbilicus was somewhat excoriated and moist from the presence of pus. The diagnosis made was septic omphalitis, resulting in hæmatogenic jaundice. Very small doses of calomel, $^1/_{10}$ grain, several times a day, were ordered; also colon irrigations with chamomile tea. The infant was nursed by its mother. Aseptic treatment of the umbilicus with sterile gauze, cleansing with bichloride, and then dusting the parts with talcum salicylicum quickly healed the inflammatory condition. The infant recovered in about one week, showing no sign of its previous jaundice.

The following case is noteworthy owing to its rarity:—

An infant was born of apparently healthy parents. Dr. Mehrenlander, the physician in attendance, stated that there was nothing abnormal at the time of birth. The infant weighed about seven pounds. It was the fourth child. Three children of this same family had previously died on the third day after birth. They were to all appearances healthy, but were jaundiced. Nothing was noticeable with them excepting the yellow pigmentation of the skin. The child died before I arrived at the bedside. It was three days old. The skin then presented a deep yellowish-green pigmentation, more marked on the abdomen. The conjunctival mucous membrane was deeply pigmented. There was no inflammatory condition noticeable in the region of the umbilicus. The cord was dressed with aseptic gauze and no infection was suspected from this channel. The attending physician suspected syphilis in the father. There were no other symptoms. Neither vomiting nor diarrhœa. A stool passed before the infant died, which looked like meconium.

An interesting point about the case is that this was the fourth child in that family which died of icterus neonatorum a few days after birth. The child died without any apparent suffering, showing no symptoms of illness. The temperature when taken was normal.

Zweifel describes a series of cases of icterus resulting from the effects of chloroform passing through the placenta. The writer has noted the association of icterus neonatorum in a large number of children born after a severe labor, requiring prolonged chloroform narcosis. This may have been *accidental, yet it is worth noting.*

James D. Voorhees, in responding to my question concerning the association of chloroform anæsthesia and icterus at the Sloane Maternity Hospital, states that "all women receive chloroform at said hospital, and about 33 per cent. of the infants born are jaundiced. All premature infants also are jaundiced."

SCLEREMA NEONATORUM.

This disease is characterized by a hardening or thickening of the skin and the subcutaneous cellular tissue. The pathological lesions have been carefully studied by Northrup. His case was a foundling born amid unsanitary surroundings. When five days old the legs were swollen and the feet as hard as a board.

The swelling spread upward, involving every part of the body. The temperature in the rectum was 35° C. (95° F.). The infant died on the ninth day. The body felt as though it were frozen. Osler also describes this condition in this country.

Symptoms.—An œdema-like swelling, very cold to the touch, and very hard on palpation, involving circumscribed areas, appears soon after birth. I have seen sclerema spread from the shoulders to the trunk and arms.

The infant appears very sick. The temperature is subnormal and recovery is rare.

Was called to see an infant five days old. Found the trunk swollen, the hands and feet cold, and the temperature in rectum subnormal. The infant refused the breast and had no strength. Brandy and water was prescribed. Mustard foot-bath ordered and one pint of warm saline solution injected into the colon. There was no nausea or vomiting. No retention of urine. Sclerema neonatorum was diagnosed. The swelling spread, involving the legs and arms, until the whole body, including the

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face, was puffed and hard. The infant could no longer open its eyes and died on the ninth day in convulsions.

HÆMOGLOBINURIA NEONATORUM (WINCKEL'S DISEASE).

Considerable has been written upon this obscure condition which is very rarely met with in the new-born baby. As a rule this condition is seen as an epidemic in a maternity hospital. Winckel reports nineteen deaths out of twenty-three cases attacked.

Pathology.—Hæmorrhages are found in various organs. The lungs are black. The bladder, the spinal canal, the liver, and the spleen all show darkened secretions. The kidneys are dark colored. All observers state that the umbilical vessels are not involved.

Symptoms.—The skin of the body has a peculiar icteric or bronzed appearance. The palms of the hands and soles of the feet have a bluish or purplish color. The conjunctiva has an icteric appearance. The stool is blackish or greenish. The urine is dark and contains blood; it is thick and sometimes resembles syrup. There is no fever. The pulse is very rapid. Convulsions and squinting are usually seen. There is a rapid diminution in the blood cells, from 5,700,000 one day to 3,400,000 on the third day.

These cases end fatally as a rule.

ACUTE FATTY DEGENERATION OF THE NEW-BORN (BUHL'S DISEASE).

When an infant is born in an asphyxiated condition and there is associated umbilical hæmorrhage, then an infection of pathogenic bacteria may take place. In some respects this disease resembles Winckel's disease. In both we have hæmorrhages as well as fatty degeneration of the internal organs. The symptoms are a bleeding from the stomach and bowels, associated with jaundice. In Buhl's disease we have bleeding from the umbilicus.

MASTITIS NEONATORUM.

The new-born infant frequently secretes a fluid in the mammæ. Females, both human and animal, occasionally secrete milk without having been previously pregnant. With regard to the milk secreted by infants, there is some doubt about its real nature. Kollicker does not view it as a true milk, but considers its appearance connected with the formation of the mammary glands. This secretion is also known as witch's milk.

Sinety, on the other hand, upon anatomical grounds, considers it a true lacteal secretion. It probably is a sort of imperfect milk, loaded with leucocytes, and this is the more likely as Vollard[1] notices that it frequently ends in abscess.

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[1] "Traité des Maladies des Enfants Nouveau-nés," third edition, 1837, p. 717.

Schlossberger gives an imperfect quantitative analysis of a sample of milk obtained by squeezing the breasts of a new-born infant, a male. In the course of a few days about a drachm was obtained. The following was the result of the analysis:—

Water	96.75
Fat	0.82
Ash	0.05
Casein, sugar, and extractives	2.83
Sugar-reaction	strong

The most complete analysis we possess of such milk is by von Gesner:—

Milk-fat	1.456
Casein	0.557
Albumin	0.490
Milk-sugar	0.956
Ash	0.826
Water	95.705
Total solids	4.295

I was called to see a female infant six days old. The mother told me that the breasts were swollen and contained milk. The same could be expressed by gentle stroking of the mammæ. The treatment consisted of the application of an ice-bag and inunctions of:—

℞ Ung. ext. belladonna	2 drachms
Ung. hydrarg. cin.	1 drachm
Cold cream	1 ounce

M. Apply on linen with tight compresses.

After several days the breasts dried and the swelling disappeared.

Another infant, three weeks old, was seen by me recently, in consultation. The mother was delivered by a midwife and her condition as well as that of the infant was apparently normal. The infant's breasts, when seven days old, appeared tender and swollen and the mother was advised to poultice them with flaxseed. This she did, and in addition *squeezed the secretion from the infant's breasts.* This traumatism caused irritation, inflammation, and finally the formation of an abscess. An incision was made, the pus evacuated and the wound healed kindly.

It is important to remember that the lacteal secretion in an infant's breast is a physiological condition, and if undisturbed will be absorbed gradually.

ERYSIPELAS IN THE NEW-BORN.

When this disease occurs in the new-born, and the mother has a septic peritonitis or other infectious disease, the infant should be *immediately isolated from the mother.* The symptoms are the same as those seen in erysipelas of older children, although vomiting and symptoms of general sepsis most often accompany this condition. The fontanel is depressed.

Prognosis.—The prognosis is usually very grave, especially so if the infant must be removed from its mother's breast.

Treatment.—The strictest antisepsis must be used. An infant should be placed under the care of a trained nurse, and all instructions in regard to the hygiene of the infant must be strictly carried out. The general plan of treatment is the same as that outlined in the chapter on "Erysipelas," page 705.

TUBERCULOSIS IN THE NEW-BORN.

The transmission of tuberculosis from the mother to the new-born is extremely rare. Cases are on record in which the tubercle bacilli were transmitted from the mother to the infant. An occasional transmission of tuberculosis takes place through the placenta. The reason for the infrequency of this occurrence is that the blood of a tuberculous patient rarely contains tubercle bacilli. Schmorl and Birch-Hirschfeld believe that maternal tuberculosis can be transmitted, but not before the end of the fifth month of pregnancy, and that the placenta is always tuberculous when the fœtus is infected. (For further details see chapter on "Tuberculosis.")

PERITONITIS IN THE NEW-BORN.

In the chapter on "Omphalitis" I have described a case of septic infection seen in consultation practice. The case recovered. At times the inflammatory condition will extend from the umbilicus to the peritoneum, and thus a septic peritonitis results.

Bacteriology.—In such pyogenic infections the streptococcus can be found. The bacteria gain entrance directly through the umbilical vessels.

Pathology.—The same lesions affecting the serous membrane, as the pleura and the pericardium, are found in the peritoneum. Adhesions frequently remain.

The symptoms, prognosis, and treatment are described in the article on "Acute General Peritonitis," Part V.

PEMPHIGUS NEONATORUM.[1]

This condition is seen occasionally in the new-born infant. It consists of blebs which contain yellow serum. In size they vary from a pea to that of a small bean. When these rupture they are replaced by superficial ulcers covered with a thin black crust. Sometimes a violet stain is left which may last for some time. The duration of each bulla is about one week. The location of the eruption is on the palms of the hands and the soles of the feet. Some authors regard pemphigus as a form of infantile syphilis. The cases seen by me have invariably occurred in poorly nourished children such as we find in athrepsia (marasmus).

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[1] See article on "Chronic Pemphigus."

CHAPTER IX.

ABNORMALITIES AND CONGENITAL MALFORMATIONS.

ANGEIOMA.

Circumscribed dilatations of the blood-vessels or capillaries are occasionally seen in the new-born baby. Spongy tumors consisting of tortuous blood-vessels of a bluish-red color are usually seen. These tumors are filled with blood and grow very rapidly. In a case seen by me (see Fig. 18) the mass was adherent to the forehead and completely obliterated the sight of the left eye. This condition is one that can easily be remedied with prompt surgical treatment. Some cases will, if neglected, ultimately result in sarcomatous degeneration.

Treatment.—Injections into the mass of a 5 per cent. nitrate of silver solution, or destroying the mass with a galvanocautery, chromic acid, or

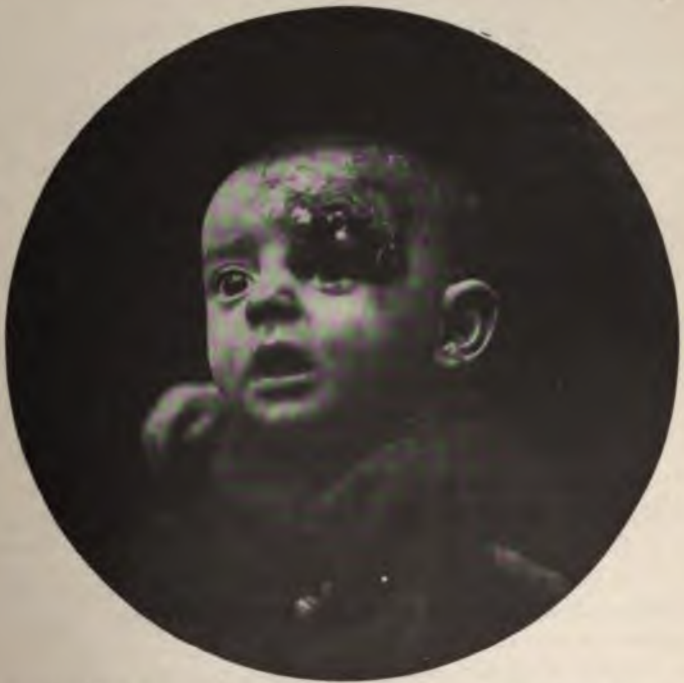

Fig. 18.—Infant ten months old. From my children's service at the German Poliklinik. The mass of bluish, tortuous vessels interfered with the eyesight. Bleeding was very easily provoked. Surgical treatment is the only means of eradicating the mass. (Original.)

nitric acid are most generally used. A good plan is to first apply pure carbolic acid, after which the fuming nitric acid should be used. This latter method is painless and effective.

HARELIP.

This congenital deformity is frequently seen in children. Sometimes it is simply "a slight indentation in the lip, or the fissure may extend to the nostril." The treatment is surgical.

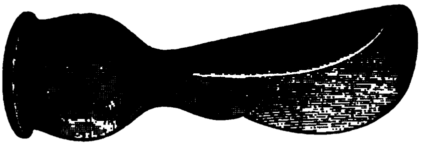

Fig. 19.—Harelip Nipple.[1]

CLEFT PALATE.

This abnormality is frequently seen in children. While the soft palate only may be affected, it not infrequently happens that the fissure extends through the hard palate, thus causing a wide gap in the roof of the mouth.

Feeding Children Afflicted with Cleft Palate.—An infant born with cleft palate has a greater struggle for existence than a child born healthy, without this deformity. It is advisable to give the best possible food, and, therefore, breast-milk only should be used. The milk should be drawn from a woman's breast by means of a breast-pump, as described in the section on "Specimen of Breast-milk for Chemical Examination."

An artificial nipple should be attached to the feeding-bottle, and to the former should be attached a flap of India rubber so made that it fits the roof of the mouth. The pressure of the nipple against the piece of rubber, when in position, converts it into an artificial palate-piece, and prevents the escape of the milk into the nose during the effort of swallowing. This shield is chosen to avoid permitting curdled milk to pass into the recesses of the turbinated bones and to cause aphthous patches. (See Fig. 19.)

It is advisable to operate on an infant for this deformity between the third and sixth months of its life, if sufficient progress in its development will warrant it.

When the above method of feeding is not satisfactory and the child shows evidences of starvation, then we must resort to gavage. (See chapter on "Gavage.")

Our aim should be to build up the infant from its birth, with breast-milk if obtainable. In one case known to me the breast-milk was pumped off every four hours and the infant was nourished by gavage with this milk. When breast-milk is not obtainable, then properly modified milk should be used, to conform with the age and requirements of the child. If the child does not assimilate its food properly, the operation should be postponed until the child is built up and strong enough to stand the operation; hence the guide for estimating the time for the operation is dependent more on proper feeding than on any other factor.

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[1] This harelip nipple can be procured from the Miller Rubber Manufacturing Co., Akron, Ohio.

Hygienic measures are very important as the irritation by food will frequently cause inflammation in the mouth. For details of the surgical treatment the reader is referred to the many good text-books on operative surgery.

TONGUE-TIE (ADHÆSIA LINGUÆ).

Tongue-tie consists of an abnormally short frænum. In some instances it may interfere with nursing, and possibly with speaking. It is one of the most trivial disorders of infancy.

Treatment.—Incise the frænum near its attachment to the tongue with a pair of curved scissors. The incision may be enlarged with the aid of some dull instrument. Some authors advise using the finger-naïl, which latter, however, is not aseptic. A tongue-tie should not be operated upon if an infection exists in the immediate surroundings.

The *after-treatment* consists in using a bland mouth wash, such as a 1 per cent. listerine solution, or 1 per cent. alum solution, especially after feeding the child.

CONGENITAL ADENOIDS.

We occasionally meet with infants in which this condition exists. This mechanical impediment prevents breathing through the nose. An infant, therefore, is at a great disadvantage, because it cannot breathe while nursing. The following case will serve to illustrate this condition:—

I was called to see an infant, Mary W., in consultation. The attending physician gave me the following history: The infant is twenty days old and weighs 6 pounds and 14 ounces. At birth she weighed 7 pounds. She was nursed at the mother's breast for about one week. The infant seemed to dislike the breast, as she would draw and immediately let go of the nipple. The mother believed the infant did not like the taste of her milk. A wet-nurse was procured, and the same trouble was encountered; the infant would take one swallow and then let go of the nipple in order to get her breath. A nipple-shield was then used, but the same difficulty was encountered. The family believed that the infant did not like breast-milk, so she was given bottle feeding. She took the nipple of the bottle, drew quite well, and then let go, when it was necessary, for respiration. I ordered spoon feeding and this worked quite well. The breast-milk was pumped from the wet-nurse and fed by spoon. This method was successful. The child swallowed a spoonful of milk and then had a chance to breathe. An examination of the rhino-pharynx revealed adenoids. These were removed with the aid of a sharp spoon, and three days later normal conditions existed.

The infant was again put to the breast when six weeks old and continued to nurse successfully for six months. She was then weaned, owing to the illness of the wet-nurse. Cows' milk was substituted. The child is to-day a perfectly healthy little girl.

PROTRUSION OF THE EARS.

Protrusion of the ears is frequently seen in children. The anxious mother will consult the physician regarding the treatment. These cases are easily managed in very young infants. A fenestrated cap,[1] closely fitting to the head so that the ears are well held back in their normal position, has served me very well. Young infants object to having their heads covered, but soon become accustomed to this cap, as it is only worn at night and removed in the morning. It is advisable to change the cap frequently, as some children perspire from its use. It must be worn for months before any benefit is noted.

In very severe cases in which the above treatment is not successful, it may be necessary to call in the surgeon. The operation is a simple one and the result is excellent.

ABNORMALITIES OF THE AIR PASSAGES.

When there is deficient oxygenation of the lungs, collapse frequently occurs, and is called atelectasis pulmonum. This condition is due to the unaerated condition of the vesicles. The trouble is usually found in the nasopharynx in the form of adenoids, unless some rare malignant condition is present.

Many pigeon-breasted children—with apparent rachitic manifestations of the thorax—owe this anatomical peculiarity more to improper oxygenation of the lungs than to improper feeding. In such children it is not rare to meet with congenital adenoids. (Read article on "Congenital Adenoids.")

It is to be understood that changing the food or giving restorative treatment, such as iron or codliver-oil, cannot cure such a child until the cause is eradicated.

CONGENITAL STENOSIS OF THE LARYNX.

In the chapter on "Inherited Syphilis" I describe a case of syphilitic stenosis of the larynx, which necessitated a tracheotomy. Several years ago a child was brought to my clinic suffering with cyanosis and difficult breathing. Intubation was tried without affording any relief. As a last resort tracheotomy was performed, but this afforded no relief. A post-mortem examination showed that we were dealing with a *diverticulum of the trachea.* In addition thereto the larynx and trachea were lined with a series of syphilitic ulcerations.

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[1] This cap can be procured at Best & Co.'s, West Twenty-third Street, N. Y.

PROMINENT STERNUM.

This is frequently called pigeon-breast. It is usually seen in older children. It is occasionally seen as a result of Pott's disease, but more frequently it is associated with rickets. It has been described by me in the chapter on "Rachitis."

DEPRESSED STERNUM.

Congenital depression of the sternum is occasionally seen in very young infants. It is more frequently seen as a funnel-shaped depression, and is a symptom of structural weakness. It more often accompanies a general rachitic manifestation to which I call attention in the chapter on "Rachitis."

HÆMATOMA OF THE STERNO-MASTOID.

During labor traumatic conditions frequently induce hæmorrhages. These conditions are, therefore, seen in natural labor with very large children, or when forceps are used. Pressure is cited by most authors as one of the causes of this condition. Henoch believes that hæmatoma of the sterno-mastoid is caused by twisting the head during labor. The swelling is due to an extravasation of blood and to inflammatory conditions of the muscle. It is rarely seen before the child is two or three weeks old. There is no treatment necessary. The blood is absorbed and the swelling gradually disappears.

CEPHALHÆMATOMA.

A swelling is sometimes seen on the top of the head during the first few days of the infant's life. It is usually associated with the application of forceps or a similar injury during labor. This condition is rare in children. The statistics of the Sloane Maternity Hospital show that this condition was met with in 20 out of 1300 consecutive births, or 1.6 per cent. There may be several swellings. They are most frequently seen over the parietal or occipital bone.

Symptoms.—A swelling that is very soft and fluctuating is noticed. This swelling gradually increases in size, and attains its maximum at the end of twelve or fourteen days. There is no pulsation palpable. The temperature is usually normal.

Diagnosis.—This condition is frequently mistaken for encephalocele. The latter, however, is always seen in conjunction with the fontanel or along the line of the sutures.

Pressure causes cerebral symptoms. This condition can be confounded with hydrocephalus. In the latter the symmetrical enlargement of the whole head is always a characteristic feature.

Baby M., seven days old, was born with the aid of forceps, after a very difficult and dry labor. When the infant was three days old a swelling was noticed on the scalp over the left parietal bone. This swelling gradually increased in size and felt soft, doughy, and fluctuating. An incision was made which liberated about four ounces of clear, fluid blood. Several days later this case was also seen by Dr. Willy Meyer, and as suppuration existed it was necessary to treat the wound on general surgical principles. The child recovered.

Treatment.—The above case illustrates the mistake that can be made. A hæmatoma is a benign condition and disappears without treatment. Bandaging and compression are unnecessary, but injury to the part must be avoided.

CAPUT SUCCEDANEUM (SPURIOUS CEPHALHÆMATOMA: SUPPLEMENTARY HEAD).

This is a swelling of the scalp due to congestion, resulting in an extravasation of the blood and lymph into the subcutaneous tissue which is external to the pericranium. This swelling does not fluctuate. It is usually seen in that portion of the head which first presents itself at the vulva during labor. No treatment is required, as this condition usually becomes normal.

CONGENITAL CYST OF THE KIDNEY.

The literature records an occasional case of this condition. There are no symptoms which would be the means of determining this condition during life. The diagnosis is therefore made post-mortem.

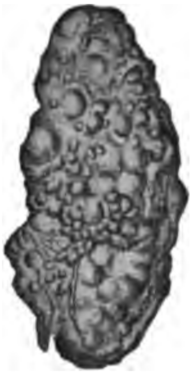

Fig. 20.—Congenital Cystic Kidney, half natural size. (Langerhans.)

CONGENITAL SACRAL TUMOR.

J. B., male infant, eleven months old, was brought to my children's service at the German Poliklinik. He was breast-fed and appeared in good health. The mother noticed a large swelling over the sacral and lumbar regions. The infant did not seem to be in pain. The growth was non-inflammatory and did not interfere with the movements of the legs. The diagnosis of congenital lipoma was made and an operation advised. The case was sent by me to Dr. Geo. F. Shrady for operation at St. Francis Hospital. The tumor was removed. The case recovered.

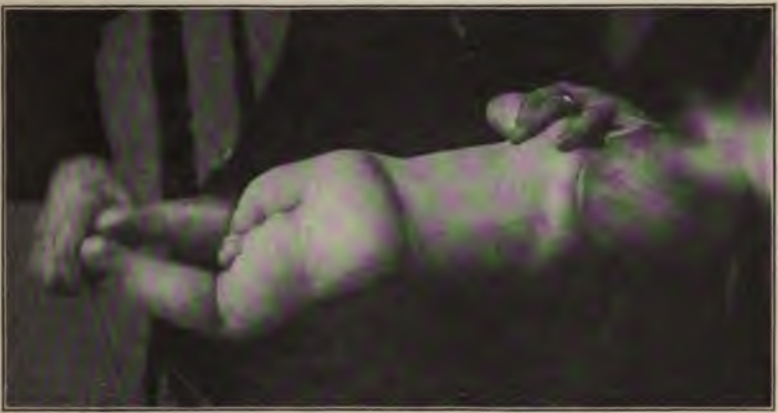

Fig. 21.—Congenital Sacral Tumor. (Original.)

CONGENITAL MALFORMATIONS OF THE RECTUM.

E. R. Kirby[1] states that these occur under the following types:—

1. Congenital narrowing of the anus or rectum, without complete occlusion. The anal aperture is at times preternaturally small, either in consequence of a contraction of the lower end of the rectum, or from the fact that the skin may extend occasionally over the border of the anal margin. The diagnosis is usually easy, for the contraction is near the anus and can be readily detected by the finger, or seen when due to a fold of skin extending across the anus. The treatment consists in dividing the ring or skin on the dorsum, and daily dilatation, either with the finger or soft rubber bougie.

2. Closure of the anus by a membranous diaphragm (atresia of the anus) is the simplest of all forms of congenital malformations, and is treated by a crucial incision through the membrane.

3. In imperforate rectum one may expect to find some of the most difficult cases of malformation, although some are comparatively simple. Instead of a normal anus the skin of the perineum extends across the anal region from side to side, and the rectum may terminate quite a distance from the normal site of the anus. The intervening space may be made up of connective tissue, while a circular elevation or depression marks the normal site of the anus. Occasionally a distinct fibrous cord may be traced

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[1] "Congenital Rectal Malformations." Archives of Pediatrics, August, 1897.

from the rectal pouch to the skin. If the rectal pouch be not at too great a distance from the skin, a sense of fluctuation may be felt by firm pressure of one finger over the anus and the hand over the abdomen.

4. The system which separates the anal and rectal pouches in cases of imperforate rectum with a normal anus is generally within easy reach of the anus. It may be perforated and slow dribbling of meconium allowed. There may also be more than one septum.

5. The anus may be absent and the rectum open at any point in the perineum or sacral region. The lower portion of the rectum in these cases is usually of a fistulous character, lined by true mucous membrane, and the abnormal anus is always narrow and insufficient for its purpose. Occasionally the rectum terminates in two distinct openings, at a greater or less distance from each other.

6. The anus may be absent and the rectum terminate in the bladder, urethra, or vagina. In females the vaginal opening is the most common; in males the vesical. This condition is usually rapidly fatal unless relieved by prompt surgical interference.

7. The rectum or the large intestine may be entirely absent.

Kirby lays down the following rules:—

1. An operation should always be performed, and performed without delay.

2. If there be any chance of establishing an opening at the normal site of the anus, the surgeon should at first direct his attention to this procedure.

3. The use of a trocar as an aid in finding the rectal pouch before or after incision through the perineum is not sanctioned by modern surgical authority.

4. The result of attempts to establish an outlet for the imperforate rectum through the perineum are not favorable as regards the production of a useful anus.

5. In case of failure to establish a new anus in the anal region, colotomy should at once be performed.

6. In the formation of an artificial anus the left groin is the best site for the operation.

7. Attempts at establishing an anus in the anal region after a colotomy are attended with great danger, and are generally unsuccessful.

PART III.

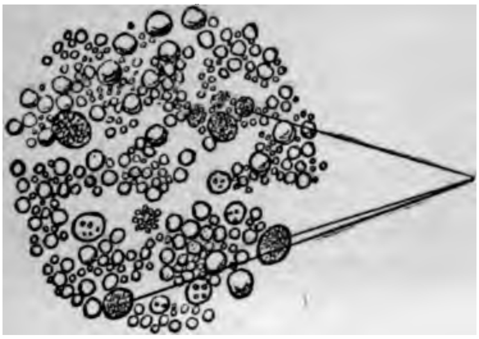
FEEDING IN HEALTH AND DISEASE.

CHAPTER I.

BREAST-MILK AND WET-NURSING.

COLOSTRUM.

Colostrum is found in the breast of a woman several hours after giving birth to her baby. It resembles milk, but is a much thinner fluid. It is always the forerunner of a healthy normal secretion of breast-milk, which usually appears on the third day after the birth of the infant.



[1] Fig. 22.—From a drop of milk on the third day after delivery, kindly furnished by Dr. H. L. Collyer, showing colostrum corpuscles. The specimen drawn by Dr. Julian W. Brandeis. (Zeiss Ocular 4, dd Lens.) (Original.)

Colostrum corpuscles have been described by Czerny as lymphoid cells, whose function is to absorb and reconstruct unused milk globules and to convey them from the milk-glands into the lymph-channels. These corpuscles usually disappear in one week or ten days after birth. When colostrum corpuscles are present after one month, then such milk will cause gastric disturbances. It is a wise plan to examine the milk microscopically whenever the slightest evidence of gastric or intestinal disturbance is noted.

According to Baginsky, colostrum contains large quantities of serum-albumin, and is also very rich in fat and colostrum corpuscles, and contains

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[1] From "Infant Feeding in Health and Disease." Louis Fischer, Third Edition.

TABLE No. 8.[1]

PROPERTIES OF HUMAN MILK.

Appearance.	Bluish, semitransparent, no odor, sweetish.
Specific Gravity.	1026 to 1036.
Reaction.	Amphoteric, relation of alkalinity and acidity as 3 to 1.
On Boiling.	Does not coagulate, and forms a very thin, hardly-perceptible skin.
Coagulates.	At ordinary temperature after several hours.
Coagulates on addition of Lab-ferment.	Coagulates imperfectly in small isolated flakes, which do not precipitate as a uniform coagulum.
Fat.	Yellowish white, resembling cow-butter. Specific gravity at 15° C., 0.966. Melts at 34° C.
Varieties of Fat.	Butyrin, palmitin, stearin, olein, myristin, caproin.
Behavior of Various Acids.	Few volatile acids. More than half of the non-volatile consist of oleic acid.
Milk-plasma Casein.	Difficult to precipitate with acids and salts. The precipitate redissolves in excess of acids. During pepsin digestion there is no pseudonuclein produced.
Composition of Albuminoids.	Lactalbumin and lactoglobin; relation of casein to albumin, 0.5 to 1.2 or 1 to 2.4; of the 1.3 per cent. albumin, there are 64 parts of casein, and 37 parts of globulin and albumin.
Solids.	Less solids than in cows' milk, especially $CaO—P_2O_5$.
Quantitative Analysis, according to Soxhlet.	Water, 87.41; albuminoids, 2.29; fat, 3.78; milk-sugar, 6.21; solids, 0.31.
Bacteria.	Usually sterile, rarely staphylococcus albus and aureus.

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[1] From "Infant Feeding in Health and Disease." Louis Fischer, Third Edition.

TABLE NO. 8a.

PROPERTIES OF COWS' MILK.

Appearance.	Opaque white or whitish yellow, in thin layers bluish white, slight odor, faintly sweet.
Specific Gravity.	.1028 to 1036.
Reaction.	Amphoteric; relation between alkalinity and acidity, 2 to 1; Soxhlet maintains that cows' milk contains three times the acidity of human milk.
On Boiling.	Does not coagulate and forms a skin containing casein and lime-salts.
Coagulates.	Coagulates very soon, owing to lactic-acid formation.
Coagulates on addition of Lab-ferment.	Coagulates to a solid mass at body-temperature, from which a yellowish fluid can be expressed.
Fat.	Yellowish-white mass. Sp. gr. at 15° C., 0.949 to 0.996.
Varieties of Fat.	Palmitin, olein, stearin, myristin, caprilin, caprin, caproin, butyrin, laurin, lecithin, cholesterin, and yellow coloring matter.
Behavior of Various Acids.	Volatile fatty acids, about 70 per cent.; not volatile, 0.3 to 0.4 per cent. of oleic; the remainder consists of palmitic and stearic chiefly.
Milk-plasma Casein.	Easy to precipitate with acids and salts; excess of acid does not dissolve; belongs to the nucleo-albumin group.
Composition of Albuminoids.	Less lactalbumin and globin; the largest portion of the albuminoids is casein. Relation of casein to albumin, 0.3 to 3.0, or 1 to 10.
Solids.	Cows' milk contains more solids than human milk.
Quantitative Analysis, according to Soxhlet.	Water, 87.17; albuminoids, 3.55; fat, 3.69; milk-sugar, 4.88; solids, 0.71.
Bacteria.	Contains all milk bacteria, frequently also pathogenic bacteria, as typhoid, diphtheria, and tubercle bacilli, etc.

a large quantity of salts. The last *two ingredients* are supposed to be the cause of the *laxative action* of the colostrum.

When colostrum corpuscles persist in breast-milk, in spite of the regulated diet and the hygienic condition of the mother, then breast-feeding must be discontinued. A very fretful and nervous mother will frequently have colostrum corpuscles in her milk. An instance of this kind was seen recently by me. Substitute feeding will frequently modify this condition unless there is a specific cause for the same. When a nursing mother is very weak and anæmic after her confinement, then iron is indicated. I saw a case in consultation recently in which the combined use of fresh air, cereals, and iron changed a thin milk containing colostrum corpuscles into a thick creamy milk in less than one month. Continued menstruation or uterine disorder with disease in the endometrium may cause profound anæmia and thus render breast-milk very thin. Such milk is totally unfit for the proper nutrition of the infant.

An analysis of colostrum milk of a cow by Harrington gave the following results (Rotch):—

Fat	1.71
Milk-sugar	4.90
Proteids	1.72
Ash	0.79
Total solids	9.12
Water	90.88
	100.00

The table which follows represents the analysis of the five specimens of human colostrum milk, also made by Harrington:—

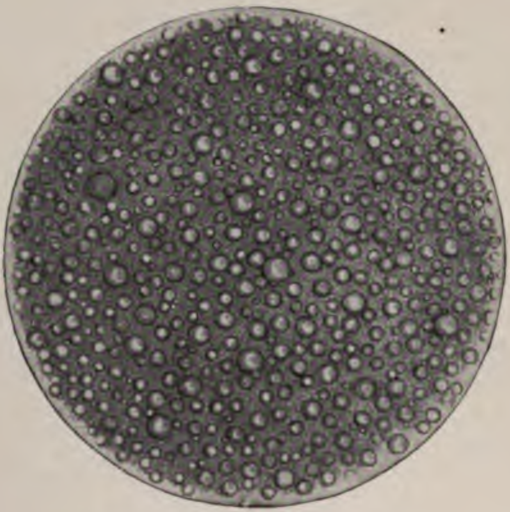
TABLE No. 9.

	I	II	III	IV	V
Fat	1.40	0.68	2.40	5.73	4.40
Milk-sugar and proteids	9.44	11.53	11.15	10.69	11.27
Ash	0.17	0.31	0.25	0.16	0.21
Total solids	11.01	12.52	13.80	16.58	15.88
Water	88.99	87.48	86.20	83.42	84.12
	100.00	100.00	100.00	100.00	100.00

BREAST-MILK.

According to Pfeiffer, human milk contains, several days after the birth of the baby, a large quantity of albumin, salt, and a small quantity of fat. He also found that *the longer the period of nursing the smaller the quantity of albumin,* which, in the eleventh month, sinks quite low. There

PLATE IV



A Drop of Normal Breast-milk from a Primipara. (Original.)

is also a ***decrease in the quantity of salts,*** whereas the ***amount of sugar*** steadily increases. The ***fat varies*** constantly. According to Johannessen, the quantity of albumin in the first six months is 1.192 per cent.; in the next six months 0.989 per cent.; and at the end of the year 0.907 per cent.

Breast-milk varies according to the length of time that it remains in the breast, and also the length of the nursing period; so it has been shown that the first milk taken at the beginning of the nursing act is the poorest in nutrient value, whereas the last milk is richest in fat. The longer the milk remains in the glands of the breast, the more will the solid substances of the same be absorbed, so that only a watery solution remains. If sucking is commenced, this stimulation soon changes the character of this watery milk, so that normal milk will soon be secreted. Forster studied the chemical constitution of the first, middle, and the last portions of milk from a nursing woman, with the following result.

In one hundred parts he found:—

TABLE NO. 10.

	First Portion of the Nursing Act.	Second Portion During Nursing.	Third Portion at the End of the Nursing Act.
Water	90.24	89.68	87.50
Nitrogenous Substances	1.13	0.94	0.71
Fat	1.70	2.77	4.51
Sugar	5.56	5.70	5.10
Ash	0.46	0.32	0.28

The quantity examined was 37.3 grams.

From a study of the foregoing tables we find a decrease of nitrogenous substances during the course of the nursing, a steady increase in the amount of fat, and an unvarying percentage of sugar. Thus, it is apparent that, in order to submit *a specimen of breast-milk to a chemical examination,* it is necessary to stimulate the secretory functions of the mammary glands by putting the child to the breast at least two minutes; thus an even milk can be procured. If this rule is overlooked, then we shall find proportions in the chemical components of milk which might otherwise be entirely different. The most recent chemical analysis of breast-milk shows that in a hundred parts there are:—

Solids	11.5
Liquids	88.5

Of the solid constituents there are:—

Casein	1.2 to 1.03
Albumin	0.5
Fat	0.8 to 4.07
Milk-sugar	6 0 to 7.03
Ash	0.2 to 0.21

The above is the chemical examination of a good average breast-milk. I again call attention to the fact, however, that not only does the milk vary in different women, but it also varies in the same woman during one single nursing act.

The albuminoids of milk consist of real casein, lactalbumin, globulin, and opalisin. This latter body has only recently been discovered by A. Wroblewski, and more recently by Schlossmann.

Phosphorus exists in milk as nuclein-phosphorus. Wittmaack has demonstrated the fact that the phosphorus in woman's milk exists as an organic nitrogen compound in the casein.

According to the examination of Stolasa, lecithin contains a larger quantity of phosphorus in woman's milk than in cows' milk.

The specific gravity of breast-milk varies from 1026 to 1036.

The Mammary Glands.—The mammary glands of the same woman may yield somewhat different milk, as shown by Sourdat and later by Brunner. Also the different portions of milk from the same milking may have different compositions. The first portions are always poorer in fat (Parmentier, Peligot, and others).

According to l'Heritier Vernois and Becquerel, the milk of blondes contains less casein than that of brunettes: a difference which Tolmatscheff could not substantiate. Women of weak constitutions yield a milk richer in solids, especially in casein, than women with strong constitutions.

According to Vernois and Becquerel, the age of the woman has an effect on the composition of the milk, so that we find a greater quantity of proteids and fat in women 15 to 20 years old and a smaller quantity of sugar. The smallest quantity of proteids and the greatest quantity of sugar are found at 20 or from 25 to 30 years of age. The milk with the first-born is richer in water—with a proportionate diminution of the quantity of casein, sugar, and fat—than after several deliveries. The influence of menstruation seems to slightly diminish the milk sugar and to considerably increase the fat and casein.

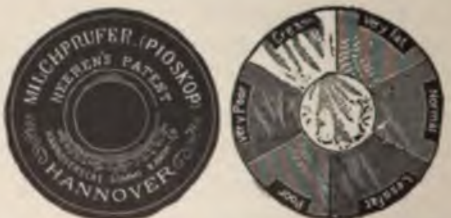


Fig. 23.—Heeren's Pioscop, for Optical Milk Test.

Pioscop.—One drop of milk can be examined in the pioscop and compared with the colors on the same. This is a rapid but rough method of estimating the richness of the milk.

Specimen of Breast-milk for Chemical Examination. — After the third, possibly the fourth, day the average healthy woman secretes milk that gradually becomes normal in quality and quantity, depending on her general condition. It is usual for an infant to lose some weight during its first week of life, owing to various physiological changes, added to which is, no doubt, the deficiency in the quality and quantity of its food. It is a safe plan, and one that I have always urged, if at all possible, to send a specimen of breast-milk to a chemist and submit the same to a chemical analysis. In some women a specimen can be examined when the baby is one week old; in others it is better to wait until the end of two weeks. We then would have a proper working basis, and know just how much fat, carbohydrate (sugar), and albuminoids—including proteids—we are feeding. Noting the weight of the child, its sleep, its digestion, color and frequency of its stools, we can easily see in one week how much the infant has gained in weight, and its general condition. To take a specimen, it is advisable to have all utensils absolutely clean; hence the following plan would be suggested: Boil an ordinary one or two-ounce bottle in water, to which a pinch of baking soda has been added, for about one-half hour. Then place the bottle in plain water and boil again for a half-hour. Then turn the bottle upside down, and allow it to drain and dry. In this manner we can completely sterilize the inside of the bottle and avoid contamination.

Withdraw a sample of breast-milk by means of a breast-pump. One which has served the author very well is known as the Florence breast-pump, and has a glass mouth-piece. (See Fig. 33.) Another form is an English breast-pump, having a rubber bulb. Compressing this bulb, we can suck about an ounce or more in from five to ten minutes. This milk is to be poured into the bottle, and well corked, and set in a refrigerator, but

TABLE NO. 11.—*Comparative Analyses of Breast-milk.*

Human Milk.	Fat.	Proteids.	Sugar.	Ash.	Authority.
Normal Milks.					
Average	2.90	3.07	5.87	0.16	A. W. Blythe.
Average	3.68	1.70	7.11	0.20	Marchand.
Average	2.67	3.92	4.37	0.14	Vernois & Becquerel.
Average	3.52	2.01	5.91	. . .	Hammarsten.
14 analyses from same woman	2.53	3.42	4.82	0.23	Simon.
Mean of 6, aged 23-33 years .	3.82	2.04	5.93	0.42	H. Gerber.
Average	3.55	1.52	6.50	0.45	Chevalier & Henry.
From woman aged 18	3.20	2.39	6.83	0.29	J. Bell.
From woman aged 33	2.99	2.51	6.51	0.30	J. Bell.
4 days after delivery	4.30	3.53	4.11	0.21	Clemm.
9 days after delivery	3.53	3.69	4.30	0.17	Clemm
12 days after delivery	3.31	2.91	3.15	0.19	Clemm.
Average of 84 samples	4.13	2.00	6.94	0.20	Leeds
Average of 107 samples	3.78	2.09	6.21	0.31	König.

not on the ice. Milk will keep for many hours in this way. My plan has been to inform the chemist the day previous to submitting the sample, so that it can be withdrawn from the breast early in the morning—at about 8 A.M.—and sent to the laboratory at once. The result of the analysis can be received on the evening of the same day or on the following day in all instances. A point worth noting is that the very first milk—known as the foremilk—should not be used, but the infant should be allowed to suck at the breast for about two minutes before pumping the sample. After this the breast-pump should be applied for five minutes to procure the so-called middle milk for examination; then the infant can again be put to the breast to finish the so-called end of nursing or to suck the strippings.

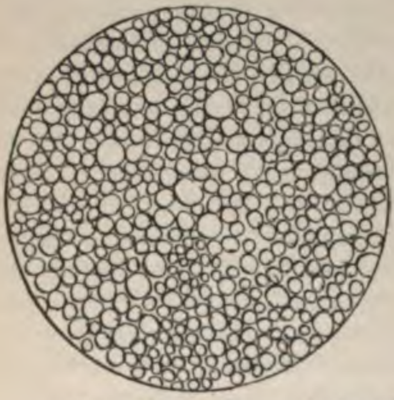


Fig. 24.—Specimen of Breast-milk from a Young Mother, 17 years old. Primipara. Baby four months old; thriving; gaining in weight; stools yellow; sleeps well. Chemical examination: Fat, 2.60; sugar, 6.50; proteids, 2.54. Milk looks creamy, and the mammæ are well filled. (Original.)

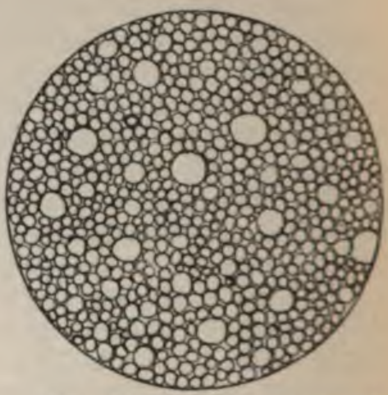


Fig. 25.—Specimen of Breast-milk, Illustrating Very High Fat, Causing Gastric Disturbance. Baby gaining; vomits frequently; stools yellowish; bluish white milk; child sleeps well; excessive fats. Chemical analysis: Fat, 5.0; sugar, 6.50; proteids, 1.74; ash, 0.20. (Original.)

Examination of Breast-milk.—A method which can be employed in general practice is recommended by Friedmann (*Deut. med. Woch.*, Jan. 23, 1902). It is more easily done than a chemical analysis, and serves an equal purpose. It consists of determining by microscopical examination the number and character of the milk corpuscles. It is an advantage first to become familiar with the normal conditions by repeated examinations of the milk from healthy mothers, those whose children are well and show no signs of rickets or glandular enlargements. The milk corpuscles can be divided as to size into three groups, large, small, and intermediate, of which the latter are most numerous. The small ones are also found in almost equal numbers, but the large ones are comparatively scarce, a magnification of 400 diameters showing only about 10-20 in the field. If these be more numerous the milk is found to be too fatty and more difficult to digest. A preponderance of the small corpuscles usually means a chronic dyspepsia for the nursing infant. An accurate count can be made with some form of blood-counting apparatus, but the latter is not essential. The proximity of the corpuscles to each other also serves as a guide to the grade of the milk, the more sparsely distributed the globules and the greater the number of the small ones, the poorer the quality of the milk: The method also serves to differentiate the character of the milk from the two breasts. In the selection of wet-nurses it is obviously useful.

Reaction of Human Milk.—Bordet has called attention to the precipitation of the albuminoids in milk when it is added to the serum in anima's which have been previously injected with milk from the same source. Schlossmann found, further, that the fluid from a hydrocele on a breast child was also able to precipitate the albuminoids in human, but not in cows' milk. Moro now announces that if a few drops of human milk are added to a few cubic centimeters of fluid from a hydrocele, in a few minutes the hydrocele fluid coagulates into a solid mass. This reaction does not occur with cows' or goats' milk. The hydrocele fluid evidently contains fibrinogen, and the milk, fibrin ferment. The combination of the two induces the coagulation. It occurs even with minute quantities of the milk; all the serum in contact with the milk coagulates around it. The same reaction occurs when human serum is added instead of the milk, but much less pronounced and much slower, and the same difference is observed when the human milk is boiled or long heated. Particles of coagulated ox blood also induced a slow and partial coagulation.

Diastatic Enzyme in Human Milk and in the Stools of Nurslings.—Dr. Ernest Moro reports from Escherich's clinic, in Graz, that:—

First.—Human milk contains, normally, an intensive, saccharifying enzyme, which is not found in cows' milk.

Second.—This enzyme is found in the stool of breast-fed children and signifies a more pronounced diastatic action of the same.

Third.—This diastatic enzyme is secreted by the glands of the intestine. Parts of the same can be found in the pancreatic juice of the new-born.

Fourth.—The intestinal contents and fæces of nurslings contain at birth, as a rule, a diastatic enzyme, which increases in the first few weeks of life.

Immunity Conferred by Breast-milk.—The nursing infant is usually exempt from infectious diseases, although we do find an occasional case of infection in a breast-fed infant. Such is the exception rather than the rule.

Read chapter on "Measles" for cases of immunity seen by me in the Riverside Hospital.

There seems to be an immunity conveyed to the infant through its mother's milk. These substances which convey immunity have been studied by Brieger and Ehrlich. During epidemics nursing infants rarely succumb to infections. The following case will illustrate the manner in which immunity can be "conveyed" through the milk:—

A woman suffering with diphtheria was four months pregnant at the time of infection. She was injected with 2000 units of antitoxin and recovered in about six days. Several months after the birth of her child, an older child in the family was attacked with diphtheria, which required several injections of antitoxin, also intubation, to relieve a severe form of croup. Although the new-born infant was in the same room it did not show any signs of the disease. This was most likely due to the immunity conferred upon the child by its mother through her breast-milk.

The following case is interesting on account of the high percentages of fat the breast-milk contained (Mendel):—

A young mother, wife of a physician, was nursing her first child, which showed marked symptoms of digestive disturbance. An analysis of the breast-milk showed the following:—

Fat	5.40
Sugar	6.50
Proteids	1.70
Salts	.20
Total solids	13.80
Water	86.20
Total	100 00

The mother, a "well-fed" individual, was immediately put on a *low diet*, with as much exercise as seemed proper. The child soon improved as the fats in the breast-milk decreased.

TABLE NO. 12.—*Five Analyses of Human Breast-milk.*[1]

	Case No. 1. Per cent.	Case No. 2. Per cent.	Case No 3. Per cent.	Case No. 4. Per cent.	Case No. 5. Per cent.
Water	86.2	89.0	87.0	88.6	88.1
Proteids	1.7	1.3	1.6	1.1	1.1
Lactose	6.5	5.8	6.6	6.7	6.2
Fat	5.4	2.5	3.8	2.7	4.1
Salts	0.2	0.3	0.2	. .	. .

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[1] Analyses made by Lafayette B. Mendel, Yale University, New Haven, Connecticut.

TABLE No. 13.—*Table Showing Analyses of a Normal, a Poor, an Over-rich, and a Bad Human Breast-milk.*[1]

	Normal Milk. Exercise and Good Food.	Poor Milk. Poor Food. (Low Fat, High Proteids.)	Over-rich Milk. Rich Food, No Exercise. (Excess of Fat.)	Bad Milk. Wet-nurse Menstruating. (Low Fat, Low Proteids.)
Fat	4.00	1.00	6.59	.65
Sugar	6.50	6.50	6.69	6.50
Proteids	1.75	2.36	1.16	1.12
Mineral Matter	.19	.24	.19	.11
Total Solids	12.44	10.10	14.63	8.38
Water	87.56	89.90	85.37	91.62
Total	100.00	100.00	100.00	100.00

Specimens examined by Mr. Bailey, chemist of the Pediatrics Laboratory.

BREAST-FEEDING.

During the first month feed every two hours, but never oftener. During the second month every two and a half to three hours.

During the day disturb the child every two hours, to be nursed; but during the night leave the child rest as long as it appears satisfied. This rule applies to healthy children only. In sickness special rules for feeding are required. If the child thrives and gains in weight, then it is advisable and in the interest of the mother and child to have an interval of from seven to eight hours at night; thus Bouchut advises feeding between 10 and 11 at night, and commencing the morning meal at 6 A.M. If the child is restless, then turn it from side to side; in other words, changing its position and giving it one or two teaspoonfuls of boiled water will frequently satisfy it and prolong its sleep.

TABLE No. 14.—*Time for Feeding.*

From Birth Until 1 Month Old.	From 1 to 2 Months Old.	From 2 to 4 Months Old.	From 4 to 6 Months Old.	From 6 to 9 Months Old.	From 9 Months Until 1 Year Old.
6 A. M.	6 A. M.	6 A. M.	6 A. M.	6 A. M.	6 A. M.
8 A. M.	8 A. M.	8.30 A. M.	9 A. M.	9.30 A. M.	10 A. M.
10 A M.	10 A. M.	11 A. M.	12 Noon	1 P. M.	2 P. M.
12 Noon	12 Noon	1.30 P. M.	3 P. M.	4.30 P. M.	6 P. M.
2 P. M.	2 P. M.	4 P. M.	6 P. M.	8 P. M.	10 P. M.
4 P. M.	4 P. M.	6.30 P. M.	9 P. M.	12 Midnight	
6 P. M.	6 P. M.	9 P. M.	12 Midnight		
8 P. M.	8 P. M.	12 Midnight			
10 P. M.	12 Midnight				
12 Midnight	3 A. M.				
2 A. M.					

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[1] I am indebted to the chemist of the Walker-Gordon Laboratory for a series of chemical analyses herein reported.

The first three or four days require *special* feeding methods. On the day of the birth, the exhaustion of the mother and presence of colostrum, besides the normal deficient quantity of food in the breast, demand large intervals of rest. Thus for the first three days (unless the milk-supply is profuse) putting the infant to the breast once in six hours is sufficient; if, however, the supply of milk is ample, then we can follow the table given above and nurse the infant every two hours.

SUGGESTIONS FOR BREAST-FEEDING.

The mother or wet-nurse should always sit upright, be it at night or during the day, while nursing the infant.

Danger of Suffocation.—A great many cases are on record where the mother or wet-nurse has fallen asleep while nursing and smothered the infant. For this reason it is important that the infant should sleep in its own crib or bed, and should never sleep with the mother or nurse.

Shall an Infant Receive but One or Both Breasts for One Meal?—This depends on the infant's appetite. Some infants appear satisfied after nursing from one breast, and will let go of the nipple and fall asleep. Lightly tapping the cheeks of the infant will awaken it, or the withdrawal of the nipple from the infant's mouth will frequently arouse it to continue nursing. If, however, the infant will not renew its nursing, and still continues to sleep, and if the infant has nursed steadily for ten minutes, then the sleep should not be disturbed.

Length of Time for Nursing.—A good plan is to note the time when the nursing act commences and stops. No infant should nurse longer than twenty minutes, whereas frequently ten or fifteen minutes will suffice. If an infant nurses more than twenty minutes, say thirty or forty minutes, then we may be sure that the breast-milk is deficient in quantity and a specimen should at once be submitted for a proper chemical examination.

SCANTY BREAST-MILK REQUIRING MIXED FEEDING.

When there is a deficiency in the quantity of breast-milk, but the quality is good, then it is advisable to feed the infant alternately with breast-milk and bottle-milk. At the same time it is advisable to direct attention to the mother's general condition, and see if we cannot tone her up, and thus improve both quality and quantity of her milk. Frequently a subnormal or an anæmic condition requires iron. A day's outing to the country or seashore, with moderate exercise, will stimulate and increase the flow of milk. Every drop of breast-milk is so precious that no infant should be deprived of it, and wise is the physician who will insist upon giving all breast-milk. When there is deficient lactation, supply the deficiency by giving a properly diluted milk or cream mixture, adapted for the age and weight of the infant.

To Increase the Quantity of Breast-milk.—Some of the galactagogues have given me satisfaction, in addition to a nutritious diet, such as meat, milk, and eggs. A preparation on the market known as *Nutrolactis*[1] has proven a most valuable galactagogue. It is given in tablespoonful doses three times a day. This will not only stimulate the quantity but also the quality of the milk. Grandin and Jarman, in their text-book on "Obstetrics," recommend the strong infusion of galega officinalis when the flow of milk is scant. This is to be ordered in tablespoonful doses three or four times a day.

Somatose in Cases of Deficient Lactation.—"A primipara who secreted only a limited amount of colostrum, and kept that up so that the child was crying from hunger and had to be artificially fed was put upon somatose, 4 teaspoonfuls a day, and in three days the patient secreted a sufficient quanity and quality of milk to satisfy the child, which increased one-fourth of a pound regularly each week. It seemed difficult to induce the mammary glands to perform their proper function; but when somatose was given there was a normal supply of milk, and the child was properly nourished without artificial feeding."

Do Drugs Taken by a Nursing Woman Affect the Baby?

Physiological experiments have frequently demonstrated the fact that a great many drugs can be given to an infant through the milk; thus, opium and morphine and narcotics in general do affect the infant, when taken by the mother. Baginsky calls attention to this fact in his text-book on "Diseases of Children": "Alcohol, when taken by the mother, is transmitted through the milk, but not in very large quantities. The following is a list of drugs which have been found in milk: The purgative principles of rhubarb, senna, and castor-oil; the metals, antimony, arsenic, iodine, bismuth, lead, iron, mercury; the volatile oils, like copaiba, garlic, and turpentine; also salicylic acid, and the iodides and bromides." Do not give cocaine, chloral, atropine, or hyoscyamus. Care is to be used with the following: Digitalis, antipyrin, and ergot. An unpleasant flavor can be imparted to the breast-milk by the mother or wet-nurse eating onions, turnips, cauliflower, or cabbage.

Disturbances During Breast-feeding.

Quite frequently we meet with gastro-intestinal disorders in infants that are wholly breast-fed. These disturbances are due to *(a)* insufficient exercise; *(b)* faulty diet; *(c)* extreme nervous irritability; *(d)* menstruaation while nursing; *(e)* physiological changes in the woman causing an improper ratio of ingredients. Some of the causes just mentioned can easily be remedied. On the other hand a very nervous woman whose anxiety keeps her constantly fretting during the day and awake at night, will hardly be adapted for breast-feeding, and the sooner the infant is removed from such a breast, the better for the infant.

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[1] Sold in all drug stores.

The following cases will illustrate the above conditions:—

An infant was nursed by its mother. The mother was extremely nervous, fretful, did not sleep at night, and nursed her child too often.

The infant suffered with colic, had greenish, cheesy stools, and did not gain in weight. Had indigestion and all evidences of intestinal colic. The case was seen by me through the courtesy of Dr. A. A. Richardson, of New York City. The physician assured me that the mother would not leave her home, and that she had had no outdoor exercise, no fresh air, and nothing but the constant worry of a sick, crying baby which she nursed as best she could. A chemical examination of the breast-milk showed the following:—

Fat	1.20
Sugar	6.50
Proteids	1.70
Ash	.18
Total solids	9.58

Under the influence of exercise and careful diet the fat was increased. In this case we alternated breast and bottle feeding, and gave the child mixed feeding. A formula of 2 per cent. fat, 5 per cent. sugar, and 0.75 per cent. proteids, was prescribed at the Walker-Gordon Laboratory.

An infant one month old was seen by me in the family of Dr. J. Grosner, of this city. The infant had been vomiting, had had colic, and was very restless. The mother was very nervous, but had an abundance of milk. From the history I learned that the child had an explosive vomit; the food coming out besides large quantities of gas. There were five to seven stools in twenty-four hours. The bowels moved at each nursing. The chemical examination of the breast-milk showed:—

Fat	4.00
Sugar	6.50
Proteids	3.05
Ash	.30
Total solids	13.85

From this examination it can be seen that for a baby six months old there was an excess of fat and also a very high percentage of proteids.

An infant one to two months old requires 2 per cent. of fat. Note also a normal infant receives between 1 and $1\,{}^1/_2$ per cent. of proteids, while this child received more than 3 per cent. of proteids. There being a profuse secretion of milk, the child received far more than it could digest in both quality and quantity. The feeding interval was lengthened, and the time of nursing was reduced to five minutes, whereas until the appearance of vomiting the child nursed twenty minutes. An ounce of sterilized water was ordered immediately after each nursing, hoping to thus dilute the milk. This method proved successful.

A Case of Prolonged Lactation, Showing Deficiency of Nutriment.—A child, about one year old, was brought to me with the following history: It has no teeth. Can neither stand nor walk. It is colicky. Does not sleep well. Does not gain weight. The child was nursed every three or four hours. The mother was very nervous, and *menstruated almost every month* during lactation. The chemical analysis of the milk gave:—

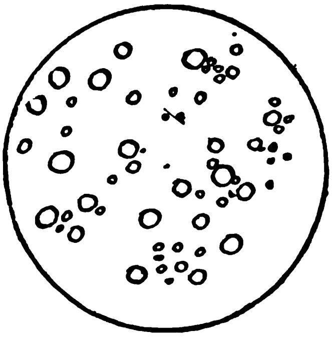

Fig. 26.—Showing a Drop of Milk under the Microscope. Note the poor character of this emulsion, the uneven fat-globules, and their irregular size and distribution. The infant nursed with the above milk was rachitic and colicky. Although 15 months old, no tooth had appeared. The mother of the infant states that she menstruated every twenty-one or twenty-two days since her infant was born—during this present nursing period. (Original.)

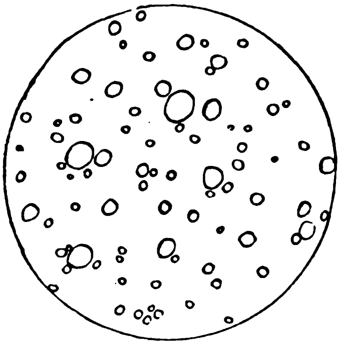

Fig. 27.—This Drop of Breast-milk is from a very Anæmic Woman. The child was extremely emaciated; had greenish stools, and colic, and was always crying. Note the uneven character of above emulsion, when compared with Plate IV. The infant was poorly nourished; had rickets and marked cranio-tabes. Mixed feeding was resorted to, with decided improvement. (Original.)

Fat	1.22
Sugar	7.07
Proteids	.98

It was very evident that this baby was receiving poor milk, *very low fat*, and *deficient proteids*. The infant was weaned, artificial feeding was prescribed, and the infant immediately showed a gain in weight. The symptoms of colic disappeared.

Illustration of Prolonged Lactation Without Apparent Harmful Effects.—An infant fifteen months old was brought to me for the relief of constipation. It had ten teeth, was able to stand and walk, and was beginning to talk. The infant was still breast-fed. The analysis of the milk gave the following:—

Fat	2.86
Sugar	6.78
Proteids	1.76

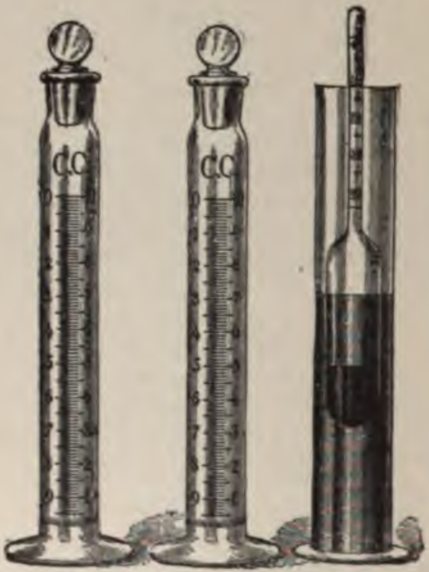

Fig. 28.—Holt's Milk Test Set, for Testing Human Milk.

The infant's weight in this case was normal, and I must regard this prolonged lactation, showing such good result, as an *exception* rather than a rule.

ADDITIONAL FOODS DURING THE NURSING PERIOD.

When a nursing infant is six to nine months old, certain additional foods can be given; thus, for example, the white of a raw egg can be given every second day, and on the alternate day several ounces of a meat soup (beef or chicken) in which barley, farina, or sago has been boiled and strained. This method of feeding can be kept up until the child is about 1 year old. A small piece of zwieback or rusk can be allowed every day. As this is hard children like to nibble on it. It seems to soothe their gums.

Flour-ball Feeding.—This is highly recommended by Dr. Edwin Rosenthal.[1] He says: "I use the following formula, and I can claim as good results therefrom as from any form of home modification. It is known as the flour-ball food, commercially imperial granum. It is made as follows:—

"Plain wheat-flour is boiled in a bag for five hours; it is then baked in an oven until perfectly hard and dry. After cooling it is broken open, the rind rejected, and grated into a powder. For a child one month old I order:—

Scalded milk	½ pint
Sterile water	1 pint
Grated flour-ball	1 heaping tablespoon

"The milk is placed on the fire and heated; the flour is rubbed into a paste with the water and added to the milk. This is brought to the boiling point, taken from the fire, set aside to cool, and then placed on the ice. Finally add enough raw milk to make two pints in all. At feeding time the required amount is heated to feeding temperature.

"For a child one month old, two ounces is given every two hours. It is increased a half-ounce every month."

I advise using the following formula for a child six months old:—

Flour-ball	1 teaspoonful
Rice water	4 ounces
Raw milk (certified or guaranteed)	4 ounces
Granulated sugar	1 teaspoonful

Rub up the flour-ball with a little rice water, and gradually add the full quantity. Add the sugar, and lastly the raw milk. Heat to a temperature of 150° F. for two or three minutes.

One bottle containing the above can be given instead of a breast-feeding, or if the milk is scanty we can alternate a breast-feeding with a bottle-feeding of the above formula. If this feeding agrees, but the child appears hungry after the bottle, the milk may be increased and the rice water decreased gradually, one ounce at a time, until full milk is given. The guide for increasing the food should be a yellowish pasty condition of the stool, the increase in weight, and the absence of colic.

The Diet of a Nursing Mother.

Immediately after the birth of the child the exhausted condition of a woman following labor will certainly call for rest; hence sleep is imperative, after which some form of stimulation is required. This can best be accomplished by giving at intervals of several hours good wholesome food, as chicken broth or beef broth, weak tea, or strained gruel. It is unnecessary to state that each woman's case and her former habits must be taken into consideration in prescribing a diet. If labor has been normal, then the nourishment will stimulate the milk. If warm liquids are not well borne, then cold drinks like buttermilk, koumyss, zoolak, or iced tea should be employed. Iced champagne will frequently do more good to allay gastric irritability than all medication. Raw milk in combination with seltzer or lime-water is indicated. In some instances ice-cream will aid nutrition and alleviate gastric irritation. If the pelvic condition is normal, then it is wise not to give solid food for the first three days, but rather, stimulate the milk-glands by giving meat broths, farinaceous gruels, and by all means milk. Zwieback soaked in milk or in tea is highly nutritious and easily digested. Other nutritious foods are calfsfoot jelly and chicken jelly.

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[1] Paper read before the Pennsylvania State Society, May 18, 1898, entitled "Some Points on Infant Feeding."

After the third day, if the pelvic organs are normal, it is wise to consider the action of the bowels. If the bowels have not moved by this time, then buttermilk added to the diet or stewed prunes or peaches, baked apples or grapes, will aid in establishing a movement of the bowels.

If the milk is scanty and the bowels have not moved, then the best remedy is a large tablespoonful of palatable castor-oil, modified to suit the taste by the addition either of lemon juice or orange juice, or by adding several drops of the ordinary spirits of peppermint. After the bowels have been evacuated and the general condition warrants it, then a diet consisting of the following is indicated:—

BREAKFAST, 7 TO 8 A.M.

Hominy and Milk.
Farina and Milk.
Rice and Milk.
Oatmeal and Milk.
Germea and Milk.
Cream of Wheat and Milk.
Some Stewed Prunes, Figs, or Peaches.
Stewed Apples.
Oranges.
Grapes.
Soft-boiled Eggs.
Poached Eggs.
Eggs on Toast.
Coffee and Milk.
Tea and Milk.
Cocoa and Milk.
Toast and Butter.
Stale Bread (2 days old), with Butter.

I do not advise meat or fish in the morning, unless the nursing mother has always been accustomed to this form of diet.

LUNCH, 12 TO 1 P.M.

Some soup made from meat, either veal, beef, mutton, lamb, or chicken, containing also some rice, barley, farina, sago, or hominy; it should not be highly seasoned, and should not be strained.

Fish, boiled or fried, and all shell-fish, particularly oysters, are very nutritious during the nursing period.

If the appetite warrants it, then a piece of steak or chop, roast beef, chicken (white meat only), or raw chopped meat, with bread and butter, is very nutritious.

EVENING, 6 TO 7 P.M.

A Bowl of Oatmeal Gruel.
Stewed Oysters.
A Drink of Milk.
Farina Pudding.
Rice Pudding.
Cornstarch Pudding.
Junket.
Cup of Tea.
Eggs, if desired.
Meat, if in the habit of eating it in the evening.

For Thirst.—Cool, filtered water, or the alkaline waters, like Seltzer and Apollinaris.

If the milk is scanty, the flow can be stimulated by drinking a cup of hot broth, made from beef, chicken or veal, lamb or mutton, several minutes before putting the child to the breast.

Alcoholic Drinks.—If the woman is in the habit of drinking wine or beer, then it is unwise to discontinue the use of alcoholics in moderate quantities while she is nursing. I have seen a great many women, whose flow of milk was scant, who immediately secreted an abundance of milk after partaking of a glass of beer or ale or porter with their meals for several days. Beer has a decided laxative effect, and this in itself is rather an advantage for those nursing mothers having a tendency to constipation. So my rule, therefore, would be to insist on abstinence from wine and beer unless the patient has been in the habit of taking it formerly.

FOODS TO BE AVOIDED BY A NURSING WOMAN.

Onions.
Garlic.
Cabbage.
Powerful Salts (Rochelle, Glauber, Epsom).
Ethereal Oils.
Butter and Fat moderately.
Candies and too much Sweets.
Large quantities of Potatoes.

Inability of Mothers to Nurse their Children.

It is surprising to note the gradual disappearance of the healthy, robust American mother who can perform the duty of nursing her infant. The following table will give a fair illustration of the conditions as they exist in New York City to-day.

TABLE NO. 15.—*A study of 1000 Mothers and their ability to nurse.*

Mothers.	Condition of Mother.	Able to Nurse 9 Months to 1 Year.	Able to Nurse 4 Days to 2 Months.	Primiparas.	Multiparas.
500[1]	Living in Tenement Houses. Very Poor.	450[2]	50	210	290
500	Living in Healthy Portions of the City. Prosperous.	84	150	305	195

According to the above statistics 90 per cent. of the poor mothers are able to nurse their children, while only 17 per cent. of the rich mothers are able to perform the same duty.

WET-NURSE.

Two important points are necessary: First, the presence of suitable milk; second, the absence of a constitutional taint or acute severe illness.

What to Examine.—First, the breasts for the quantity of milk present. The breast should be gently but firmly held at some distance from the nipple; thus we can learn by palpation regarding the parenchyma of the glands. Also the quantity of milk which, if expressed continuously about twenty to thirty seconds, should flow in several streams.

Stagnant milk always shows sensitiveness on pressure. The statement of a wet-nurse that her "milk is deficient in quantity," can be determined by subjecting her to careful observation for several hours. After this time the milk in the breasts should be expressed and the quantity determined.

The ease with which milk can be expressed by palpation is an important factor to note. If the milk flows with great difficulty, and requires considerable massage or pumping, then such a nurse is totally unfit to nurse atrophic, marasmic, or prematurely born babies.

Weak or marasmic children require a wet-nurse having a plentiful supply of milk. Thus the slightest palpation while expressing must yield a liberal flow of milk.

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[1] Thirty-five or 7 per cent. of these mothers suffered from puerperal disease, such as septicæmia, mastitis, and kindred affections, hence they were ordered by their physicians not to nurse.

[2] Three hundred and twenty-four infants were put on artificial feeding. This feeding consisted of feeding at the laboratory and home modifications. One hundred and fifty-four of these infants were supplied with wet-nurses, owing to loss of weight, dyspeptic conditions, or marasmus during the bottle-feeding.

Note if the expressing of milk causes pain; in the normal breast it should be painless.

It is not always the quality of the milk, but frequently the quantity, that is the cause of poor assimilation of a wet-nurse's milk. In such instances a chemical examination of the milk is imperative; by this we can learn exactly how much we feed an infant in percentages. If necessary, we can modify the milk (by proper wet-nurse diet) until the required percentages are attained.

The Child of a Wet-nurse.—Certain allowances must always be made for babies presented by wet-nurses—for instance, if the hygienic surroundings of a wet-nurse are very poor, and in addition thereto her food supply is meager, then a general anæmic appearance must be expected. On the other hand, a healthy, robust-looking baby must not be regarded as the criterion by which we should judge the wet-nurse.

The tricks of wet-nurses are manifold. Frequently they will procure a healthy-looking infant and pass it off as their own, in order that they may procure a position.

Another point is that they will frequently resort to stuffing their babies by feeding a bottle in addition to their breast-milk. Thus we must judge for ourselves the quality of the wet-nurse physically, and, most important of all, by the quality and quantity of her breast-milk.

Health of the Wet-nurse.—It must be borne in mind that the secretion of milk does not so much depend on her constitution as it does depend on her nervous system. Great importance must therefore be placed on the *uselessness* of hysterical or neurasthenic women for wet-nursing.

The phlegmatic temperament—the broad shouldered, easy-going woman —pleasant and gentle mannered, is the one most useful and best adapted for wet-nursing.

Wet-nurses with Goiter.—Bezy, of Toulouse, considers the question: Should women affected with goiter be accepted as wet-nurses? He does not think so because there is a certainty of danger for the infant, but because it is more prudent to exclude such women from nursing. In 1897 he saw a fatal case of tetany in an infant aged six months in which no cause could be found for the disease except the fact that the mother who nursed this baby had exophthalmic goiter. A few months later he saw another case of the same kind, and in 1898 he saw a case of tetany in an infant aged three months, who died after an illness of about forty days and whose nurse had simple goiter. The author thinks that tetany in infants may be of thyroid origin, and that the thyroid affections of the nurse are transmitted to the nurslings. He does not pretend to establish an invariable law, but simply wishes to call attention to the possibility of such transmission and to suggest further investigations on the subject.

We should reject a wet-nurse as unfit for nursing if she has:—

1. Enlarged cervical glands.
2. A goiter.
3. Diseased lungs, no matter how trivial.
4. Evidences of syphilis, such as condylomata, present.
5. Condylomata on her genitals.
6. Mastitis.
7. Carious teeth.

Recurring menstruation is no contraindication for a wet-nurse. Some women are perfectly healthy and will menstruate regularly during their period of wet-nursing, without harm to the infant.

Erosions or fissures on the nipple should not be looked upon as contraindications for wet-nursing. Infants will thrive, although changed from one wet-nurse to another. Breast-milk is not uniform in its consistency. We know that its ingredients not only change from day to day, but that the milk varies several times a day. In spite of this fact children thrive, as was demonstrated by Schlechter, who used 400 children in the Vienna Foundling Asylum. Among these an epidemic of gonorrhœal ophthalmia developed, requiring isolation. Thus, several nurses were ordered to be isolated with these infected children, and it was noted that these children developed just as well in spite of the change from their previous breast-milk.

The mortality in this same institution resulting from feeding with sterilized milk has been entirely done away with since the introduction of wet-nursing.

Finally, it is important to note that it is the quality of milk, rather than the quantity, which determines the value of breast-milk.

When children are strong and well-built, and have a ravenous appetite, they *require a slow-flowing breast-milk,* as a rapid flow of breast-milk, aided by a hearty appetite, will tend to overload the stomach, and is one of the reasons for dyspepsia in young children.

It is a good point to try to secure a wet-nurse suckling a child about as old as the one we wish her to nurse, although it is quite common to find nurses who have older children than the one they wish to nurse, and to find the latter doing well.

The proof of the usefulness of the wet-nurse is the condition of the baby after some time. If the child thrives it will increase in weight. Hence scales must be frequently used. The milk should be examined by a chemist to determine the percentage of ingredients.

Especial note should be made of the percentage of fat and proteids.

If a very quick examination is required, then a microscopical examination of one drop of middle-milk will show the character of the fat globules.

The rough method of examination is useful when the life of the infant is at stake and it is necessary to determine quickly whether or not a given wet-nurse is suitable for an infant. If a baby suddenly appears colicky or does not gain in weight while wet-nursing, then a chemical examination of the breast-milk is imperative. We can frequently find an excess of fat or, more often, an excess of proteids as the cause of colic.

Von Bunge presents the results of an investigation in which he shows that the increasing inability of mothers to nurse their infants is a matter of inheritance. He obtained information relative to 665 cases with the following result: The daughter was able to nurse her offspring in 182 cases. The mother was able in 99.2 per cent., and unable in only 0.8 per cent. The mother was able in 237 cases. The daughter was able in 53.2 per cent., and unable in 46.8 per cent. The daughter was unable to nurse her offspring in 483 cases. The mother was able in 43.2 per cent., and unable in 56.8 per cent. The mother was unable in 147 cases. The daughter was unable in 99.3 per cent., and able in 0.7 per cent.

He concluded from the foregoing figures that inability to nurse is largely a matter of inheritance. Further inquiries also led him to believe that tuberculosis and nervous diseases were to a considerable extent associated with inability to nurse one's offspring. But much more prominent appears to be the relation of intemperance. Where the mother and daughter were both able to nurse he found that the fathers were usually at least moderate in the use of alcohol, and only in 4.5 per cent. were they hard drinkers. On the other hand, when the mother was able to nurse, but the daughter was unable, it was found that the father was often intemperate, and in 46.8 per cent. was an actual drunkard. In this inquiry the author considered those only as able to nurse who could nurse all their children for a period of nine months. All others as unable.

The control of wet-nurses was very adequately discussed[1] as a public prophylaxis. Many believed it was a matter that could be brought under the control of the law.

Dr. Petrini, of Galatz, professor at the University of Bucharest, prepared an elaborate report in which the prevalence of infection of syphilis by means of wet-nurses was demonstrated. He showed that its frequency varied widely in different countries, and hence an English view, for instance, of its comparative importance, drawn from the rarity of the infection in that country, was not a criterion for the whole, since it had been shown for Oriental lands, and even for Paris, that it was an important element.

He proposes a special medical service, working in co-operation with municipal authorities and having for its head a competent syphilographer. All children being nursed by wet-nurses should be inspected regularly by representatives of this bureau, and all wet-nurses should receive authorization for their calling by the same bureau after rigorous medical examination. Special provision should be made for syphilitic children.

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[1] Second International Conference for the Prevention of Syphilis and Venereal Diseases, held at Brussels, Belgium, September 1 to 6, 1902.

Clinical Illustrations of the Variations in Wet-nurses' Milk.

The following case will illustrate the peculiarity of breast milk in a wet-nurse:—

Case I.—First examination of breast-milk showed:—

Fat	2.50
Milk-sugar	6.50
Proteids	1.93
Mineral matter	.21
Total solids	11.14
Water	88.86

When the wet-nurse was first employed, the infant gained more than eight ounces each week. Had yellowish stools, one or two each day. Slept well after nursing and appeared satisfied. Cried only at feeding time. No evidence of colic.

A second examination of the breast-milk was made to compare the character of the milk with that of the first specimen:—

Fat	2.10
Milk-sugar	6.50
Proteids	1.41
Mineral matter	.15
Total solids	10.16
Water	89.84

Two months later, same wet-nurse. Child's weight stationary. Green, curded stools, cries and has colicky pains. Restless at night. Wet-nurse is menstruating. Chemical analysis of milk shows:—

Fat	.65
Milk-sugar	6.50
Proteids	1.12
Mineral matter	.11
Total solids	8.38
Water	91.62

With the aid of cereals and malt, also a change from the city to the seashore, the milk improved. The infant was more satisfied. The stools again assumed a yellowish color. One month after this building-up treatment, an analysis of the breast-milk showed:—

Fat	3.50
Milk-sugar	6.50
Proteids	1.90
Mineral matter	.19
Total solids	12.09
Water	87.91

When the infant was eight months old the secretion of milk was scanty, so that the breast was alternated with bottle-feeding. The general condition improved. The child was again satisfied. A chemical examination of the breast-milk showed:—

Fat	3.00
Milk-sugar	6.50
Proteids	1.08
Mineral matter	.19
Total solids	10.77
Water	89.23

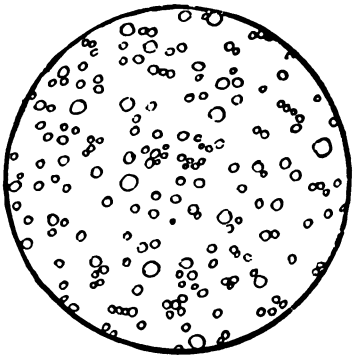
As the proteids were found to be very low, I ordered the white of a raw egg, soup, and expressed beef juice. When the child was nine months old it was necessary to wean it, as the wet-nurse had very little milk.

In this case the stationary weight, the colicky condition, and the character of the stools were important guides, and fully agreed with the analyses of the specimens given.

CASE II.—*Colic.*—An infant five months old, suffered with severe colic. It cried continuously, especially after nursing. Relief was afforded when castor-oil was given or when warm colon flushing was resorted to. Diluting the breast-milk by giving an ounce or two of barley or rice water immediately after each nursing seemed to modify, but not altogether relieve, this condition. The chemical examination of the milk gave:—

Fat	6.59
Sugar	6.69
Proteids	1.16
Ash	.19
Total solids	14.63
Water	85.37

The *excessive amount of the fat was* evidently the cause of the trouble. The quantity of meat was reduced. Exercise was ordered and beer forbidden. In a few weeks the percentage of fat in the milk was greatly reduced, and the infant far more comfortable.



CASE III.—Fig. 29.—Specimen of Breast-milk Taken from a Wet-nurse during Menstruation, Illustrating the Poor Character of the Emulsion. (Original.)

The infant was very restless, and had colicky attacks. Note the small, unevenly divided fat globules—irregular form of the larger globules. It appears to be a very watery emulsion. Chemical examination of the specimen showed: Fat, 1.60; sugar, 6.50; proteids, 2.43. The baby did not gain during the whole week.

CASE IV.—*Good Milk in a Wet-nurse.*—In this case we have a child that was gaining in weight. Appeared satisfied after nursing, but had a tendency toward constipation. A chemical analysis of the milk gave:—

Fat	4.20
Sugar	6.50
Proteids	2.80
Ash	.28
Total solids	13.78
Water	86.22

DIET OF A WET-NURSE.

The diet given for a nursing mother can also be used as a guide in choosing the diet for a wet-nurse. The greatest care, however, must be bestowed on the manner of living.

Manner of Living.—A wet-nurse that was a former servant, or worked out of doors, and is suddenly taken into this new mode of life and given charge of a baby, must have proper exercise. Otherwise she will very soon secrete milk which will be totally unfit for an infant, and as a result the child will probably have severe colic and irregular, cheesy stools; will vomit excessively, and will not gain sufficiently in weight. It is therefore important to try and adapt a wet-nurse to the same condition as existed prior to her pregnancy; so that both her manner of living and, chiefly, her diet, shall not be different.

That alcohol may be eliminated from milk is shown by a case reported by Vallani. A nursing infant was seized with convulsions with great regularity on Monday and Thursday, but was quite well on other days. Investigation showed that the wet-nurse on Sundays and Wednesdays (her days out) was in the habit of drinking freely of alcohol. The curtailment of these privileges resulted in the disappearance of the convulsions.

Proper Rest.—To be equal to her task a nurse must be given plenty of sleep, if it is at all possible.

Adriance, in the *Archives of Pediatrics*, says:

1. Excessive fats or proteids may cause gastro-intestinal symptoms in the nursing infant.
2. Excessive fats may be reduced by diminishing the nitrogenous elements in the mother's diet.
3. Excessive proteids may be reduced by the proper amount of exercise.
4. Excessive proteids are especially apt to cause gastro-intestinal symptoms during the colostrum period.

5. The proteids, being higher during the colostrum period of premature confinement, present dangers to the untimely-born infant.

6. Deterioration in human milk is marked by a reduction in the proteids and total solids, or in the proteids alone.

7. This deterioration takes place normally during the later months of lactation, and unless proper additions are made to the infant's diet, is accompanied by a loss of weight or a gain below the normal standard.

8. When this deterioration occurs earlier, it may be the forerunner of the cessation of lactation, or well-directed treatment may improve the condition of the milk.

Methods of Changing the Ingredients in Woman's Milk.

Rotch gives a condensed table for these changes as follows:—

To Increase the Total Quantity.—Increase the liquids in the mother's diet, especially milk (malt-extracts may be helpful), and encourage her to believe that she will be able to nurse her infant.

To Decrease the Total Quantity.—Decrease the liquids in the mother's diet.

To Increase the Total Solids.—Shorten the nursing intervals, decrease the exercise, decrease the proportion of liquids, and increase the proportion of solids in the mother's diet.

To Decrease the Total Solids.—Prolong the nursing intervals, increase the exercise, and increase the proportion of liquids in the mother's diet.

To Increase the Fat.—Increase the proportion of meat in the diet.

To Decrease the Fat.—Decrease the proportion of meat in the diet.

To Increase the Proteids.—Increase the exercise up to the limit of fatigue for the individual.

It is wise in all cases of *disturbed lactation,* whether in maternal or wet-nursing, to make efforts in accordance with these rules to produce a milk that is suitable for an infant who is not thriving, before changing to any other method of feeding.

WET-NURSING.

It is an established fact that the best possible food for an infant is breast-milk. Where the mother of an infant is prevented from nursing her child, the next thing to be considered is wet-nursing. That nursing a child is an advantage to the mother is a well-known fact, inasmuch as it influences the contraction of the uterus and stimulates the circulation. Contrary to the belief that nursing a child is detrimental and contraindicated in women whose lungs are weak and who have a tendency to tuberculosis, it does them no harm, and, indeed, seems to do them good. This statement is borne out by the experience of Dr. Heinrich Munk, of Karlsbad, Austria, a specialist in the diseases of women.

In Austria the state supports public institutions for lying-in women. They are kept there and confined *gratis,* and remain about fourteen days. They are admitted into these hospitals in the last months of pregnancy. Vienna usually has about 300 women on hand. Prague constantly has 100 women in this condition, who are utilized for the purpose of instruction to physicians and midwives.

In Prague there are about 3000 women confined annually, and these women are put into the foundling asylum. There they remain until they procure a place as a wet-nurse or as long as their services are needed in the asylum. When wet-nurses are taken from the foundling asylum, it is a frequent occurrence to have those remaining therein nurse at least two children, and frequently three at one time. In this manner they dispense gradually with these wet-nurses without hurting the remaining children. Many children die, some of them intrapartum in operative confinements, and the women (mothers of such children) are then utilized for wet-nursing. It is a rule to keep the children in the asylum until they have attained a little over 4 kilograms (about 9 pounds), and they are then put out for further feeding (artificial feeding), for which the city pays about 12 florins ($5.00) a month. The children remain usually until they are 6 years old, and are then given back to their own mothers. Many of these children die, others are adopted by those who have reared them, but the greater portion are taken back to their own mothers. In Vienna there are about 10,000 confinements annually in the public institution. There are a great many cities in Austria—like Innsbruck-Olmutz, Brunn, Linz, and Klagenfurt—where there are at least 200 confinements annually. In Vienna a wet-nurse receives 30 florins per month, for which she is sent (railroad expenses paid) to whoever requires her services. She is taken on trial for fourteen days to see if she is adapted for her place. A wet-nurse can be procured by sending a telegram and a money order any day during the year. The customary wages are from 12 florins upward per month. Each wet-nurse is carefully examined by the professor before she is sent away. A great many families do not care to take a wet-nurse from an asylum, as they are usually women of the lowest walks of life, and they prefer, therefore, to take a woman who has been married. For this purpose agencies, duly licensed, exist. These will supply wet-nurses, and usually take orders in advance; thus a wet-nurse may be reserved. Such wet-nurses cost much more, and those from one special region—Iglau, in Mahren—receive from 20 to 50 florins monthly.

The Empress took a wet-nurse from Iglau (a married woman), and the Princess of Bulgaria took a wet-nurse from Iglau for her last child. Not only Iglau, but the whole region, is renowned for its excellent quality of wet nurses. The Bohemian and Mahren nurses have very good mammæ. They seem to love the children entrusted to them. In America the wet nurses are uneducated servants.

While it is a rule that a wet-nurse should be taken for a baby of the same age as that of her own, frequently wet-nursing of an infant at birth by a wet-nurse whose baby is three months old has not been followed by any bad results.

In New York we are at a decided disadvantage regarding wet-nurses. As no licensed agents exist, a few people having so-called influence procure wet-nurses by friendship, or something similar, from superintendents and house physicians where obstetrical work is done.

Thus we find ourselves at the mercy of some people who traffic in wet-nurses for a fee, usually five to ten dollars, and who do not stop at anything to attain their own selfish end.

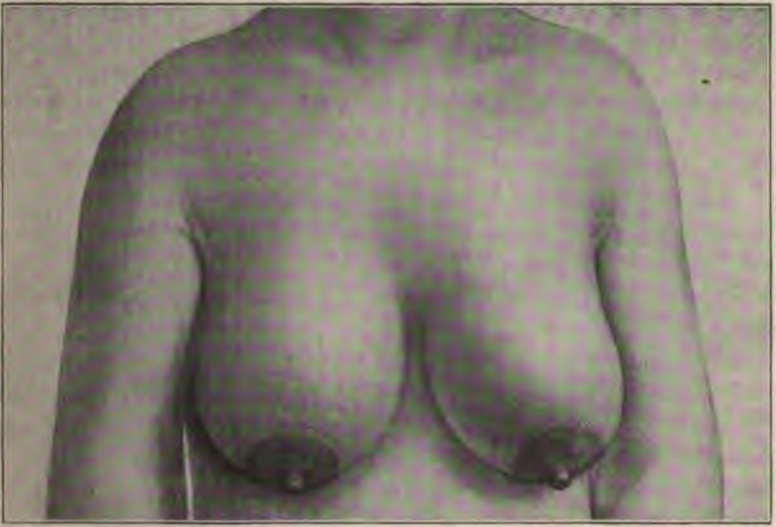


Fig. 30.—Pear-shaped Breasts, Best Adapted for Nursing. (Original.)

Time and again have I sent for a wet-nurse to an agent who, instead of giving me a healthy wet-nurse, tried to induce me to use women having colostrum-milk for an infant in which such milk would have proved disastrous.

In another instance, only recently, I procured a wet-nurse from an agent who sent me a girl 17 years old, who had had a premature birth, "evidently an abortion," and whose milk was thin and watery, with here and there a fat-globule when examined under the microscope.

At other times some of the finest specimens of wet-nurses have been procured from the same agent.

It is a pity that we have no municipal control for what the writer considers one of the most valuable adjuncts to our infant-feeding, and in the same manner such control would regulate the supply to such unlimited number that modern arrogance on the part of the wet-nurse would probably disappear.

The prices paid in New York are from $20 to $30 per month and board, and this price prohibits many an infant from securing the benefits of Nature's food. Let us hope for municipal regulation.

Weaning and Feeding from One Year to Fifteen Months.

Weaning should take place gradually between the eighth and tenth months. In some instances it is advisable to commence weaning a child much sooner; for example, when there is a deficiency in the supply of milk or owing to ill health of the mother. This I have already mentioned in the section on "Mixed Feeding."

Weaning is imperative when the infant's mother is pregnant, although it is advisable to use great caution if it occur in midsummer. In a case of this kind the better way would be to have a specimen of the breast-milk examined by a chemist, and if the same be found deteriorated in quality, then the judgment of the physician must prevail as to the advisability of continuing or discontinuing the nursing. My rule has been not to wean during the summer months.

The main points have already been mentioned in this chapter under "Wet-nurse."

Weaning should not be attempted suddenly. It is better to commence weaning gradually by withdrawing the breast in the morning and substituting the bottle for that meal. Following this meal we can again nurse the child at the breast for two more feedings, and substitute a bottle for its fourth meal instead of the breast.

In this manner we can feed the infant with a bottle in the morning, to be followed in three or four hours by the breast, then at the next feeding again nurse the child, and this to be followed in three or four hours by the bottle:—

8.00 A.M.	Bottle.
11.30 A.M.	Nursing.
3.00 P.M.	Nursing.
6.30 P.M.	Bottle.
10.00 P.M.	Nursing.

Thus we can see just how the food is assimilated, and also study the individual peculiarities of the baby. Some children are very hard to wean, and it will require great tact and patience to successfully cope with this condition.

CASE I.—*Difficult Weaning.*—A child, seventeen months old, had greenish stools, and did not thrive. His body weight was stationary. He was restless both day and night. He was nursed every two hours and cried when the nipple was taken away. The chemical examination of the breast-milk showed about one per cent. of proteids and less than two per cent. of fat.

In this case the prolonged lactation was unsatisfactory. The wet-nurse was anæmic, and consequently her milk was poor. I ordered weaning from the breast. The child refused to take food by spoon or cup and would spit whenever food was forced into his mouth. It was necessary to place the child in charge of a trained nurse and remove the wet-nurse entirely from the baby. I ordered gavage with equal parts of milk and rice water. Six ounces were given at one feeding, every four hours. After two days of continued forced feeding (gavage) the child took some milk, and also soup from a cup.

CASE II.—I was called to see a perfectly healthy child, about nine months old, whose mother told me that "Her child would not take the breast." She was greatly chagrined, but all efforts at nursing him proved futile. The infant had weaned himself. Such cases of "self-weaning" are very rare.

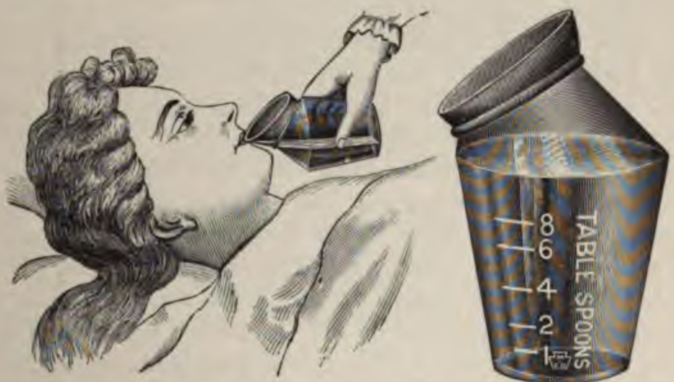


Fig. 31.—Ideal Feeding Cup.

When weaning is successfully accomplished, then great care must be exercised owing to the change in diet. It will be found that the slightest error in overfeeding or too frequent feeding will be rewarded by a severe attack of dyspepsia and the usual gastric disturbances, such as vomiting and fermentation in the stomach, causing diarrhœa and, possibly, colic. It will therefore be very necessary to exercise good judgment in the choice of both quality and quantity of food during the first month or two after weaning, or until the stomach adapts itself to this new way of feeding. *The amylolytic function now being thoroughly developed, we can safely give cereals.*

Time of Feeding.—Excepting in rare instances, after a child is weaned it should not be fed oftener than once in four hours. The best time for feeding would be about 6 A.M., 10 A.M., 2 P.M., 6 P.M., and 10 P.M., if the child is awake. This would give eight hours' rest, ***and all healthy children can be trained to sleep that length of time.***

The first bottle after sleeping should consist of 8 ounces of pure cows' milk. This would be the 6 A.M. feeding.

Four hours later, or at 10 A.M., the infant should receive the white of a raw egg fed with a spoon from a wine glass immediately before its bottle, which consists of:—

Cows' milk	5 ounces
Barley water	3 ounces

At 2 P.M. our feeding should consist of 8 ounces of pure cows' milk. I usually permit the infant to nibble on one-half piece of ordinary zwieback.

The evening meal at 6 P.M.:—

Cows' milk	6 ounces
Barley water	2 ounces

The last feeding, at 10 P.M. if the child is awake, or at midnight, should consist of 8 ounces of pure cows' milk.

When milk is brought from the dairy there is a thick layer of cream on the top which should be thoroughly mixed with the milk by shaking the bottle, so that the infant receives a thoroughly mixed milk containing the same quantity of cream in each feeding. The milk should be mixed and the barley water added to it. It is then poured into thoroughly cleaned bottles, which are stoppered with ordinary cotton stoppers. This can be found described in detail in the chapter on "Sterilization." This food is to steam for twenty minutes and then allowed to cool by placing the bottles in a refrigerator, but not on the ice. When ready for use each bottle is to be warmed to a temperature of 100° F. for the feeding. If constipation follows the use of this diet, then a good plan is to substitute 2 ounces of oatmeal water instead of the barley water above mentioned. When the stools are regular but the child appears to be quite pale, then great good can be accomplished by adding 2 ounces of almond-milk instead of the oatmeal or barley water. The preparation of almond milk can be found described in the "Dietary," to which I beg to refer my readers. If a severe form of constipation, with cheesy curds in the stools, exists, then the milk should not be steamed, but fed in the "raw state." It is to be understood that it should be warmed to the body heat, before feeding to the infant. Instead of giving the white of egg every day I substitute either 1 or 2 ounces of beef soup, chicken soup, beef tea, or expressed steak juice, and feed this quantity immediately before the 10 A.M. bottle of milk. No distinct change of food is necessary until the child is twelve or fifteen months old, when I am in the habit of giving either a half-saucer of oatmeal gruel with some butter, or hominy and butter, in addition to a morning bottle. When the child arrives at this age a half-dozen teaspoonfuls of junket can be fed before the evening bottle of milk. When a child is over one year or about fifteen months old, instead of giving water for thirst I frequently give prune-water made by boiling good, fleshy prunes in water for one-half hour and straining off the liquid. When oranges can be procured, one or more tablespoonfuls of juice can be given to advantage. Apple sauce can also be given. Thus my plan consists in giving one of these foods on different days. Just at this period the addition of several teaspoonfuls of Eskay's food has been found very beneficial. Owing to gastric derangements, it will be found necessary to frequently discontinue milk entirely. At such times the use of the milk foods, such as Horlick's food and Mellin's food, has proved very beneficial. When diluting milk with cereals, like barley water, rice water, sago water, flour ball and water, it is always better to dextrinize the diluents. This dextrinization has a decided effect on the casein, inasmuch as it splits up the curd, rendering it finely flocculent as it is found in human milk, and it is especially indicated in the period of weaning after the stomach has been accustomed to breast-milk, and is suddenly forced to digest cows' milk containing a more tenacious and heavier casein, or curd.

The Management of the Nipples Before the Baby is Born.—It is very important during the last few months of pregnancy to devote considerable time and attention to the condition of the nipples. If these be found long and round, well projecting, then it is advisable to try to harden them, because the irritation from the child will cause considerable trouble unless we seek to prevent this.

Oni, in treating the question of sore nipples, said at the Medical Society,[1] that one out of every two nursing women was affected with lesions of the nipples. The determining cause of the fissures was maceration of the epiderm under the double influence of the saliva of the infant and the milk which flowed during the intervals. The epiderm exfoliated and the derm exposed became excoriated; the lesion thus produced became infected, and, instead of healing, progressed in extent. The predisposing causes were short and inextensive nipples and want of cleanliness. The primiparæ were affected with fissured nipples to the extent of 59 per cent.

The prophylactic treatment consisted in astringent lotions during pregnancy, while after delivery the nipple should be washed with boric acid lotion before and after suction, the application of an antiseptic dressing during the intervals of nursing. The curative treatment, to be radical, consisted in the suspension of nursing, which, although excellent for the mother, would be deplorable for the child. The list of agents employed against the fissure was very lengthy, indicating their uselessness. Oni applied a weak solution of sublimate (1:4000) during the period of rest, and removed the same before the child was applied, and the parts were washed with boric acid solution. Against the pain, he found a saturated alcoholic solution of orthoform to be best. Cocaine was dangerous.

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[1] Paris Cor. Med. Press and Circular.

In summer cold water will be found more agreeable, with a small quantity of alcohol. If the nipples are very small and flat, and do not protrude properly, then suction by means of a breast-pump, applied directly over the breast, will draw them out. In some instances an ordinary clay pipe which has a smooth bowl, the bowl to be laid over the nipple and the stem to be sucked or drawn, is satisfactory. This is to be repeated every few days. A few minutes of drawing out will suffice until the nipples are sufficiently prominent. Biedert[1] gives the following prescription for hardening the nipples:—

Tannic acid	1 teaspoonful
Red wine	8 ounces

If red wine is not handy, then substitute brandy in its stead. This is to be applied after thorough washing with soap and water, and removing crusts, if they are present.

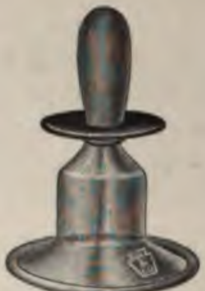

Fig. 32.—Nipple-shield for Relief of Tender Nipples.

Tender Nipples.—If, while nursing, the nipples crack and blood oozes from them, or if, from irritation of the child's gums biting them, the nipple is sore, then it is a good plan to allow the child to nurse through a nipple-shield. (See Fig. 32.)

Nipple-shields can be used during the nursing act, and immediately thereafter the following salve can be smeared on the nipples:—

℞ Zinc oxide	1 drachm
Vaseline	1 ounce

TREATMENT OF TENDER NIPPLES (GARRIGUES).

℞ Orthoform	1 drachm
Lanoline	1 ounce

M. Sig.: Apply.

BREAST-PUMP.

The breast-pump (Figs. 33 and 34) is a valuable addition to the nursery. It should be kept scrupulously clean by immersing it in boiling water containing a pinch of table-salt. In drawing a specimen of breast-milk for a chemical examination the breast-pump is very useful. If an infant is ill and refuses the breast—as, for example, if it has rhinitis or cold in the head, nasal obstruction, preventing it from breathing while the nipple is in its mouth—it generally will take the breast and immediately let go of it again.

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[1] "Kinderernaehrung," fourth edition, 1900, page 110.

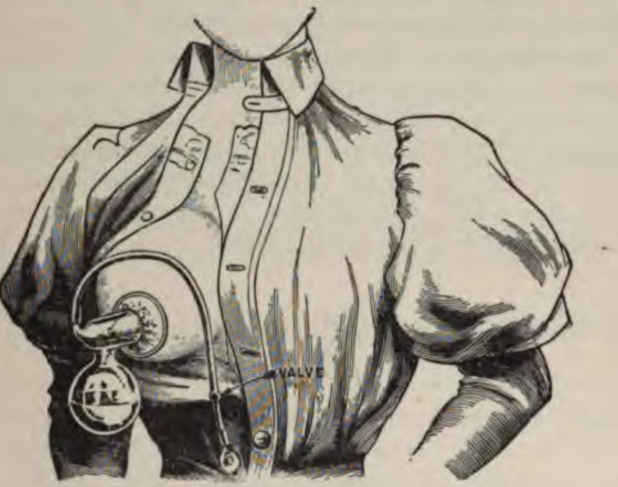

Fig. 33.—Breast-pump.

If the breast-pump is properly applied, and the required quantity of milk drawn off, the infant can frequently be fed slowly with a spoon.

In a serious condition—as, for example, in a severe case of pneumonia with loss of appetite—the life of the child may depend on forced feeding. This will be described in the section on "Gavage." It is very important to have the cup or any other receptacle into which we draw the breast-milk properly sterilized; otherwise the breast-milk will be infected in the same manner as has been described in detail in the sections on "Cows' Milk" and "Bottle-feeding."

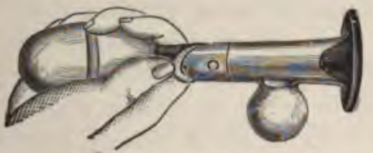

Fig. 34.—Breast-pump.

Massage of the Breast During Lactation.

Caking.—The "caking," or hardening, of the breast is not due to curdling of the milk. This never takes place within the milk-tubes, nor yet to the presence of milk, for as a rule no milk is formed, according to the writer, until nursing begins, or if any, but a very small amount. The hardening of the gland is due to the congestion of the blood and lymph, and therefore massage should be directed to the removal of these, and likewise should be centrifugal in direction, and not aim to the removal of the milk by centripetal stroking. The blood supply of the gland is mainly derived from the subclavian and axillary arteries, the venous outflow and the lymph discharge is by corresponding channels, and this is the anatomical basis for action. The massage should begin gently below the clavicle and in the axilla, and gradually encroach more and more on the mammary region. By this method a hard and painful breast is rendered lax and comfortable without the discharge of any milk. The writer does not recommend the treatment where there is infection or true inflammation, as in mastitis; in such conditions rest is indicated and nothing should be done which will tend to spread the infection.[1]

PROTEID INDIGESTION IN NURSING INFANTS, CAUSING COLIC AND CONSTIPATION.

1. Colic.—One of the most frequent disorders in nursing infants is colic. This colic usually appears about one hour after nursing. Sometimes it appears a little sooner, sometimes a little later. Associated with this colic is the usual evidence of pain. The attack appears in the following manner: In about an hour after nursing, the child, which up to this time has been quiet or asleep, will suddenly awake with a shriek and scream. At the same time it will draw the legs on the abdomen, get very red in the face, and continue to scream for a few minutes. Such an attack will last from fifteen to twenty minutes; at other times as long as one hour. Relief is usually afforded by gently rubbing the abdomen with warmed sweet-oil or vaseline; in other words, by using gentle massage. Besides the oil, an enema, consisting of warm water and glycerine, or warm chamomile tea, usually affords relief by removing the offending and undigested caseine. The stool will usually be found to contain large quantities of undigested cheese. Small white particles can be seen scattered through such stool.

It is not uncommon to find, where such a condition exists, that the attacks will appear after each nursing. A distinct association between the condition described and the nursing must be suspected. When this condition is suspected, then the milk must be examined by a chemist to determine the percentage of its ingredients. If the percentage of caseine is found excessive, then exercise by the nursing mother will be called for.

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[1] See an elaborate paper on this subject by Bacon in American Journal of Obstetrics.

Sometimes reducing the nitrogenous food and drinking large quantities of liquid, will modify the amount of caseine, so that the milk will not be so concentrated. If the child continues with this colicky condition, then we must instruct the mother regarding exercise. It is well to give the infant a small quantity of oatmeal water; several teaspoonfuls will suffice after each nursing. In other instances giving the baby small quantities of pancreatine, or a combination like the Fairchild's peptonizing powder, will be found advantageous. This can be given so that we peptonize the food and aid in the digestion and assimilation of the same.

We are dealing with mother and infant, and a great many changes will be demanded. Care should be bestowed upon the condition of the mother's bowels. The slightest constipation should be modified by giving her a saline. A teaspoonful of Epsom salts in the morning, repeated in the evening if necessary.

She should eat large quantities of fruit, such as peaches, prunes, grapes, apples, and oranges.

2. **Constipation.**—Another result of proteid indigestion is constipation. When we are told that large, dry, cheesy curds are evacuated, then the cause of such indigestion should be sought.

If the infant is nursing, the proper method to pursue is to examine a specimen of breast-milk under a microscope, using the middle milk for this purpose. Submit a specimen to a chemist or to a laboratory and note the percentage of ingredients.

If there is a deficiency in the percentage of fat, such deficiency can be remedied by giving the baby an equivalent of cream. If there is a deficiency of carbohydrate, we increase the same by giving the baby some sugar. When there is proteid deficiency we can modify the same by adding raw albumin (white of egg) or almond milk, pea soup, lentil soup, or broth made of meat.

The above will give a choice between animal or vegetable proteids.

Infant Mortality and a Study of the Mode of Feeding.

Table No. 16.—*Registrar General—England and Wales, 1890-94.*

Year.	Total Births.	Total Deaths.	Deaths Under 1 Year.	Deaths from Diarrhœa.	Deaths from Diarrhœa Under 1 Year.
1890	869,937	562,248	130,955	17,837	11,795
1891	914,157	587,925	135,801	13,962	9,200
1892	897,957	559,684	132,463	15,336	10,487
1893	914,572	569,958	145,061	29,721	20,722
1894	890,289	498,827	121,799	10,763	7,360

TABLE NO. 17.—*Mortality Table for London, 1890-94.*

Year	Total Births.	Total Deaths.	Deaths Under 1 Year.	Deaths from Diarrhœa.	Total Under 1 Year.
1890	128,161	87,689	20,941	2,823	1,983
1891	134,484	89,122	20,776	2,496	1,829
1892	132,328	86,833	20,441	2,642	1,884
1893	133,062	89,707	21,814	3,546	2,601
1894	131,454	75,635	18,812	1 771	1,324

TABLE NO. 18.—*Deaths Due to Diarrhœa and Mode of Feeding* (*Cameron*).

Age in Months.	Cases Investigated.	Percentage of the 153.		
		On Breast Only.	On Breast Partially.	On Bottle
0- 3	41	24	20	56
3- 6	55	16	13	71
6- 9	34	3	9	88
9-12	23	30	17	52
	153	18	14	68

Eröss collected statistics from sixteen cities of Europe, and found that of 1,439,056 children born, there died 130,610 during the first four weeks of their life, or nearly 10 per cent.

TABLE NO. 19.—*Two Hundred Deaths—Their Mode of Feeding* (*Louis Fischer*). *Inquiry into 200 Deaths, Taken at Random at the Children's Service of the German Poliklinik and West Side German Dispensary.*

Age in Months.	Cases Investigated.	On Breast Only.	On Breast Partially.	Bottle Feeding Only.
0- 3	78	5	8	65
3- 6	30	7	12	11
6- 9	64	12	16	36
9-12	28	9	12	7
	200	33	48	119

The above children were inhabitants of both the East and West Side of New York City, living in crowded apartments. The hygienic factor is, therefore, an important one. Sixty per cent. of these children died from gastric and intestinal disease. About 30 per cent. died from catarrhal diseases affecting the air passages, such as bronchitis, pneumonia, and tuberculosis. The rest died from infectious diseases and surgical accidents.

CHAPTER II.

COWS' MILK.

Hammersten[1] gives the following analysis of cows' milk in a thousand parts as follows:—

Water		874.2
Solids		125.8
Fat	36.5	
Sugar	48.1	
Salt	7.1	
Proteid (casein, 28.8; albumin, 5.3)	34.1	

A. Baginsky[2] gives the following analysis of cows' milk, made at the Kaiser and Kaiserin Friedrich Hospital, Berlin:—

Water	87.60
Solids	12.38

In one hundred parts.

The solids consist of:—

Casein and albumin	3.65
Butter	3.11
Milk-sugar	4.54
Inorganic salts	1.08

Besides large amounts of potassium and potassium salts and small quantities of iron.

Composition, Variation, and Production.—Milk of all animals, roughly speaking, is composed of the same ingredients, but an analysis of milk is apt to be very misleading, as it does not show the physical condition of the milk, which is the important thing to know from the physician's standpoint.

The general ingredients of milk are fat, sugar, albumin, casein, salts, and water. These ingredients vary in quantity from day to day, and from milking to milking. An average analysis of a woman's milk does not show what an infant is getting, by any means, for the composition of the milk depends upon the food, the health of the mother, and the frequency of nursing.

The Breed of a Cow.— Some breeds yield quantity, others quality. Holsteins produce the most milk; Alderneys and Jerseys yield the most fat; Shorthorns give the most casein and sugar. The average capacity of a cows' udder is about 5 pints, and the annual yield of milk is about 600 gallons.

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[1] "Physiological Chemistry."

[2] "Diseases of Children," 1899, page 32.

Time and Stage of Milking.—Cows are usually milked twice a day, the morning milk usually being larger in quantity and poorer in quality. The milk which is first drawn is known as the fore-milk, and contains very much less fat than that last drawn, known as the strippings. This is due to a partial creaming taking place in the udders. Dishonest dealers have often taken advantage of this fact in adulteration cases to have the cows partially milked in the presence of ignorant witnesses, the resulting milk consisting largely of the fore-milk.

Age of Cows.—Young cows give less milk, while cows from four to seven years old give the richest milk, and less milk is given with the first calf. They give the largest yield, according to Fleishmann, after the fifth until the seventh calf; after the fourteenth calf they yield, as a rule, no more milk. The poorest milk is yielded during the spring and early summer; the richest during the autumn and early winter. If cows are worried or driven about, the quality and quantity of the milk are reduced. If they are kept warm and well fed, both quantity and quality are naturally increased.

According to Rotch, the *Durham,* or *Shorthorn,* represents the best type of cow for this purpose. She has great constitutional vigor, great capacity for food, a perfect digestion, and most important of all, a quiet temperament. The analysis of her milk is as follows:—

	Per cent.
Fat	4.04
Sugar	4.34
Proteids	4.17
Mineral matter	0.73
Total solids	13.28
Water	86.72
	100.00

The *Devon* is another breed of cow having the same characteristics as the Durham. They are gentle and vigorous, and yield a large quantity of rich milk, the analysis of which is as follows:—

	Per cent.
Fat	4.09
Sugar	4.32
Proteids	4.04
Mineral matter	0.76
Total solids	13.21
Water	86.79
	100.00

The *Ayrshire*, another type, while representing strength, is somewhat nervous, and while not as hardy as the Durham, they are free from disease and yield a large quantity of milk, the analysis of which is as follows:—

	Per cent.
Fat	3.89
Sugar	4.41
Proteids	4.01
Mineral matter	0.73
Total solids	13.04
Water	86.96
	100.00

The *Holstein-Friesian,* commonly called *Holstein,* represents the most perfect type of cow. She yields a large quantity of milk, though light in its total solids. The following is the analysis:—

	Per cent.
Fat	2.88
Sugar	4.33
Proteids	3.99
Mineral matter	0.74
Total solids	11.94
Water	88.06
	100.00

Some of the marks which distinguish the breeds of cows best adapted for infant feeding are:—

1. Constitutional vigor..
2. Adaptability to acclimatization.
3. Notable ability to raise their young.
4. Freedom from intense inbreeding.
5. A distinctly emulsified fat in the milk.
6. A preponderance in the fats of the fixed glycerides over the volatile glycerides.

The volatile glycerides do not exist in the mammæ, but are formed in the milk soon after milking. In some breeds, as in those of the Channel Islands, this change occurs more quickly than in others. Such breeds as the Jersey, Guernsey, and any others in which intense inbreeding has been carried on, and in which acclimatization has not been perfected, should not be used for infants and young children. These breeds, of course, do not represent all of those available for substitute feeding, for we may mention many others equally good each in its country. For example, the Kerry, of Ireland; the Red Polled, of England; the Dutch Belted, and the Flemish; also, the Flamande and the Cotentine, of France; the Norman breed, of Normandy; besides the Sirmenthal, sometimes called Bérnese, of Switzerland; together with the Chianina, of Italy, and the Allgauer, of Germany. The native cow of this country, the "Red Cow," through many generations of neglect and exposure in winter, has undoubtedly acquired an impaired digestion, and does not respond readily to appropriate changes of food.

Care of the Cow.—Knowing the cow to be a sensitive animal, she should be carefully guarded from useless excitement. She should be carefully groomed by cleaning and washing, and the parts should be thoroughly dried. The barn should have plenty of fresh air and the sunlight should be admitted. There should be plenty of room for exercise. In the stalls the cow should have perfect freedom for her head and limbs. The food a cow receives should be wholesome and varied. She should never be fed with the by-products of brewery or glucose factories. The food best adapted for the cow is hay, wheat, bran, ground oats, and cornmeal. In winter sugar beets and carrots may be added. Much care is needed to graduate the change from green foods to dry, as disturbance of the equilibrium of the mammary gland is followed by injurious effects to the consumer. We should strive to give a cow green clover, green corn, green oats, and meadow grass. Poisonous weeds must be guarded against. Not infrequently we read of gastroenteric conditions in children, which are traceable to poisonous weeds. *Pure water in large quantities must always be at hand.* A cow is best adapted for the production of milk between her third and ninth years. The milk of a cow is not adapted for infant feeding until it is free from colostrum corpuscles. It should not be used in the advanced stage of pregnancy.

Tuberculin Test.—Every dairy now resorts to prophylactic measures, hence none should be employed that has not been subjected to the tuberculine test. Besides this, each cow should be examined by a skilled veterinarian regarding her physical condition.

Care of the Milk.—The vital point consists in excluding germs and barn filth. The Milk Commission of New York has tentatively fixed upon a maximum of 30,000 germs of all kinds per cubic centimeter of milk. A cubic centimeter is about one-half a teaspoonful, and a quart of milk contains about 900 cubic centimeters, so the total number of germs in a quart must be less than 27,000,000.

This standard must not be exceeded in order to obtain the endorsement of the Commission, and must be attained solely by measures directed toward scrupulous cleanliness, proper cooling, and prompt delivery.

Furthermore, the milk certified by the Commission must contain not less than four per cent. of butter fat, on the average, and have all other characteristics of pure, wholesome milk.

In order that dealers who incur the expense and take the precautions necessary to furnish a truly clean and wholesome milk may have some suitable means of bringing these facts before the public, the Commission offers them the right to use caps on their milk jars stamped with the words: *"Certified by the Commission of the Medical Society of the County of New York."*

Rowland G. Freeman, answering an inquiry of mine concerning the possibility of procuring milk free from germs in the dairy, says: "By means of special methods it has been found possible in some cases to obtain milk with only 10 bacteria per cubic centimeter. These methods are, however, not practicable for a large commercial supply. When the conditions at the dairy are known to be good a bacterial content averaging less than 5000 per cubic centimeter has seemed to me satisfactory, while a bacterial content averaging less than 10,000 is fairly good."

Thus it appears, that with excellent care, as described in the handling of milk, with modern hygiene, practically sterile milk can be procured for infant feeding.

CERTIFIED MILK IN NEW YORK.

The dairy rules of the United States Department of Agriculture describe in detail the caring and feeding of cattle. It was decided that the acidity of milk should not be higher than 0.2 per cent., and that the number of bacteria should not be more than 30,000 per cubic centimeter.

The Rockefeller Institute for Medical Research inaugurated a periodical inspection of the dairies and milk of the dealers who were willing to cooperate to secure a clean, fresh milk.

It was observed that the milk from a cow milked in a dirty barn showed 120,000 bacteria to the cubic centimeter, while another cow of the same herd milked in a pasture gave milk with only 26,000. A cow standing near a pile of dry feed had 1,000,000 bacteria per cubic centimeter, while the milk of other cows had a low bacterial count. Dirty cows gave a much higher count of bacteria than clean ones. Clean cows in a herd gave a count of 2000 as against 90,000 in the milk of the dirty cows. The milker was frequently found to be dirty, and the milk from some milkers always gave a high bacterial count. With the utensils it was sometimes difficult to find which factor was at fault. The ordinary strainer was, however, a prolific source of bacteria.

With a sterile pail and a sterilized cotton or cheese-cloth strainer the bacteria would fall in numbers. Aeration by requiring more complicated apparatus increased the danger of contamination. This was particularly so if aeration was carried out in a dirty barn or without regard to strict cleanliness.

The process of rapid cooling is one of the most important factors in the production of uncontaminated milk. The cooling of milk in springs is seldom sufficient, as the temperature of water in summer was found to vary from 45° F. to 70° F., whereas the milk should be brought below 45° F.

to insure few bacteria. Ice is absolutely necessary to the farmer who handles milk. W. H. Park *(Yale Medical Journal)* says, as to the number of bacteria in the city milk: "From an examination of nearly 1000 specimens there is no question about the enormous number of bacteria present in the city milk. Now as to the harmfulness of this milk: The group of children under 1 year, on heated milk, received from decent farms, running before heating from 1,000,000 to 5,000,000 bacteria per cubic centimeter, did not, so far as we could see, suffer any serious harm from the bacterial products in the milk. During the summer these children had, off and on, intestinal disorders, but not much more than those in the same section of the city receiving milk from the very best possible dairies around New York. The children on pasteurized milk showed some very interesting results.

"There were very few bacteria in this milk when first received—anywhere from 10,000 to 20,000; but on the second day they had so increased as to be from 10,000,000 to 30,000,000. In some cases where the second day milk was given there was immediate vomiting, followed by diarrhœa.

"***Bacterial Count of Milk Bought in a Public Park During the Summer of 1904.***—**One cubic centimeter of Strauss's sterilized, modified milk contained 22,624 bacteria. Growth of colonies was upon nutrient gelatine, and count was made thirty-six hours after growing the plate.**

"In the asylums, where the children were from 3 to 13 years of age, we found no trouble from the milk during the summer months, although in some cases it ran as high as 100,000,000 bacteria per cubic centimeter.

"As controls, we watched infants in the hospitals and in the tenements taking breast-milk, and these not infrequently developed intestinal disorders, showing that we could not in all infants taking cows' milk attribute these disorders to the milk impurities. Altogether it seems that fairly numerous bacteria in milk obtained from clean, healthy cows living on good farms, do not cause harm in the older children and the products do not cause much harm to younger children when subjected to heat. When milk contaminated badly and improperly kept, so that the bacteria greatly multiply, is fed to babies, they do badly, and it seems that much of the mortality is due to poisonous conditions of the milk developed by the bacteria.

"The reasons for the enormous development of bacteria in the milk were insufficient cleanliness in getting the milk and very faulty cooling arrangements. The farmers mostly put their milk in springs; as the summer advances the water gets higher in temperature until it reaches about 60° F. Some farmers hardly cool their milk at all. The author has seen milk shipped in cans standing in a car where the temperature was 90° F., and left there without any ice for seven hours. The City Health Board has passed a rule that all milk shall be at a temperature of 50° F., or under, when it reaches New York City.

"The Health Department found that milk from a decent farm properly cooled will not run over 100,000 bacteria per cubic centimeter at the end of twenty-four hours, and that such milk, if kept for two days at 45° F., will not run more than 200,000. Therefore, all milk that runs over 100,000 bacteria per cubic centimeter, has certainly not been kept in a proper condition, and such a number of bacteria indicates faulty methods of caring for the milk. The Health Board has passed a resolution saying that milk containing excessive numbers of bacteria is unwholesome and should not be sent to New York."

EXTRACT FROM THE "SANITARY CODE," DEPARTMENT OF HEALTH, CITY OF NEW YORK, 1901.

"No milk which has been watered, adulterated, reduced, or changed in any respect by the addition of water or other substance, or by the removal of cream, shall be brought into, held, kept, or offered for sale in the city of New York; nor shall any one keep, have, or offer for sale in the said city any such milk.

"The term 'adulterated,' when used in this section, means:—

"*First.*—Milk containing more than 88 per centum of water or fluids.

"*Second.*—Milk containing less than 12 per centum of milk solids.

"*Third.*—Milk containing less than 3 per centum of fats.

"*Fourth.*—Milk drawn from animals within fifteen days before or five days after parturition.

"*Fifth.*—Milk drawn from animals fed on distillery waste, or any substance in a state of fermentation or putrefaction, or on any unhealthy food.

"*Sixth.*—Milk drawn from cows kept in a crowded or unhealthy condition.

"*Seventh.*—Milk from which any part of the cream has been removed.

"*Eighth.*—Milk which has been diluted with water or any other fluid, or to which has been added or into which has been introduced any foreign substance whatever.

"*Ninth.*—Milk, the temperature of which is higher than 50° F."

TUBERCULOUS INFECTION THROUGH MILK.

The question of tuberculous infection by ingestion of milk is answered in the negative by N. Aspe (*Rev. d. Med. y Cir. Prac.*, Nov. 21, 1901). If the tubercle bacillus reaches the cow's udder, it must necessarily be carried thither by the blood. The bacillus has yet to be found in the blood; but, supposing its presence there, we are taught to believe that every gland in the body, by its selective power, takes from the blood only those elements which are necessary to the elaboration of its peculiar products. This would seem to dispose of the possibility of infection of the milk before it leaves the cow's body, unless the elective faculty, attributed to other glands, be denied to the mammary. Granting this possibility, if we recall that in the production of experimental infections by subcutaneous inoculation, the first organs to be affected are the lymphatics, it is natural to suppose that the first and invariable effect of the ingestion of tuberculous milk would be the development of tabes mesenterica, yet primary tabes is comparatively rare. The author of this paper further raises the question of identity between the human and bovine tubercle bacillus, and quotes experiments in inoculation of cows with cultures from human tuberculous products with negative results in the nineteen animals experimented upon, whereas, animals injected with the bovine form quickly succumbed, and autopsy showed tuberculous lesions.

The Influence of High Temperature on Tubercle Bacilli in Milk.—Barthel and Stenstrom (*Centralblt. f. Bakt.*, October 8, 1901), in reviewing recorded experiments on the sterilization of tuberculous milk, remark on the very variable results obtained by different observers. Bang has stated that heating tuberculous milk to 80° C. is not sufficient to kill the bacilli, but that a temperature of 85° C. is sufficient for the purpose. Forster has found 70° C. for five to ten minutes capable of killing the organisms; De Man, 70° C. for ten minutes, and 80° C. for five minutes. Galtier has shown that milk submitted to 70°, 75°, 80°, and 85° C. for six minutes, is still capable of conveying infection, and others have had similar results. *Barthel and Stenstrom have conducted experiments which go to show that the chemical reaction of the milk has much to do with the facility with which it is sterilized.* The material was obtained from a cow with an udder in an advanced state of tuberculosis. Guinea pigs were used to test the results, and the effect of 65°, 70°, 75°, and 80° C. were studied. The results were positive in all cases; that is to say, a temperature of 80° C. for ten minutes, a temperature of 75° C. for fifteen minutes, 70° C. for fifteen minutes, and 65° C. for twenty minutes were all incapable of sterilizing the milk. These results the authors interpret as follows: Storch has shown that the chemical changes in milk are the more marked the more advanced the disease of the udder, and that the reaction becomes more and more markedly alkaline. On the other hand, it has long been known that it is more difficult to sterilize an alkaline than a neutral, and a neutral than an acid fluid. The specimen with which they worked was strongly alkaline, and to this they ascribe the difficulties in its sterilization. Variations in chemical reaction explain, in their opinion, the variations in the results obtained by other investigators.

The Tuberculin Test of Pure-bred Cattle.—Mr. D. E. Salmon, D. V. M., Chief of the Bureau of Animal Industry of the United States Department of Agriculture, has recently issued a pamphlet in which he demonstrates the necessity of guarding against the importation of disease by means of cattle, and upholds the present regulations to prevent such occurrences as proper and consistent. The chief danger to cattle arises from the prevalence of tuberculosis, which disease affects herds more widely and more disastrously than any other.

Even if the point urged by Professor Koch at the British Congress on Tuberculosis be granted, and it is allowed that the spread of tuberculosis by milk and meat is to be feared but to a slight extent, the fact must still be borne in mind that tuberculosis, in itself, is a decimating factor among cattle of immense importance.

Mr. Salmon shows that the United States has a very large export trade in cattle, and one that is continually increasing. He further points out that rigid restrictions are in force in many countries in the world to prevent tuberculous beasts from gaining an entrance into those territories; consequently, if we wish our cattle to enter those markets, they must not only be free from tuberculosis when they leave the farm, but also when they arrive in a foreign country. To effect this object, every effort must be put forth to keep out tuberculous cattle from this country, for a few thus diseased will quickly spread contagion.

The argument is therefore advanced that the tuberculin test as now adopted, must be strictly enforced to guard against such a result. The contention is likewise made that the pure-bred cattle mainly imported from Great Britain are the chief menace in this respect, and that, if the tuberculin test were not strictly adhered to, the blue-blooded immigrants from the United Kingdom would disseminate the germs of tuberculosis among cattle from one end of the country to the other.

Tubercle Bacilli Disseminated by Cows in Coughing, as a Possible Source of Contagion.—The general belief at the present time that the means by which tuberculosis is chiefly disseminated, by the inhalation of dried tuberculosis sputum which becomes pulverized and is carried about by currents of air, or put into motion in other ways, has been strongly substantiated by numerous experiments. Flügge, however, is not in accord with these views, and is of the opinion that the spread of tuberculosis is due mainly to the inhalation of minute particles of sputum which the act of coughing thus ejects. He further holds that these particles float in the air for a considerable period of time, and may be blown hither and thither by very slight currents. Klebs, in this country, has demonstrated the fact that, during the act of coughing, minute particles of sputum, often containing tubercle bacilli, are thrown out. At his instance, too, Curry, of Boston (*Boston Medical and Surgical Journal,* October, 1898, vol. cxxxix, No. 15), carried out a series of elaborate experiments with the object of thoroughly investigating the matter.

Dr. Curry concluded from his experiments that, although there is a possible, and even a probable, danger from this source, Flügge has greatly exaggerated this danger. Dr. Mazyck, lecturer and demonstrator of bacteriology, Veterinary Department, University of Pennsylvania, has been led to undertake experiments to see if it were not possible that cows in the act of coughing would likewise expel small particles of tuberculous material rich in tubercle bacilli. The results of these studies were made the subject of a paper by Dr. Mazyck, which was read before the Pathological Society of Philadelphia on November 8, 1900. The belief is common that cows when coughing swallow all their sputum, and do not project it to any extent. Dr. Mazyck, by ingenious methods devised by himself, has disproved this theory, and has practically demonstrated that, in the act of coughing, cows, as well as men, atomize, so to speak, their sputum, and project it into the air in minute particles, which may float for some time. Inoculation of guinea pigs with this secretion gave a considerable proportion of positive results. Dr. Mazyck came to the conclusion that the danger of infection by means of this atomized sputum, as far as mankind goes, is confined practically to those in constant contact with the animals, but for other animals in the same stable the infected animals must be considered a source of danger. The moral to be derived from the outcome of Dr. Mazyck's experiments would seem to be that when tuberculosis is diagnosed in a cow, she should be isolated as far as is possible; at any rate, she should not be confined in a shed with healthy animals.

Sterilization and Pasteurization vs. Tubercle-free Herds, etc.[1]—The comparative dependence upon sterilization or pasteurization and the insurance of absolute absence of tubercle in herds supplying milk are discussed by Hope, who thinks that while raw milk is especially liable to contamination, sterilization, valuable as it is, is, after all, only an expedient, and must not be put in such prominence that the importance of the other safeguards of absolute cleanliness of source and handling are neglected. Beyond any question, he says, the ultimate advantage lies in obtaining the milk from herds free from tuberculosis. A comparison is made with having water from a contaminated source and making it pure later by chemical processes or boiling it, and obtaining it in the first place from an uncontaminated source. He thinks it is quite possible to insure that the milk supply shall come from cows free from tuberculosis.

The State Veterinarian of Pennsylvania, Dr. Pearson, thinks that not over 2 per cent. of the cattle of that State are tuberculous, and probably if a general test of all the cattle of the other States mentioned were made, we should find a very much smaller proportion tuberculous than is indicated by this tabular statement. The explanation of the high percentages that have been given is found in the fact that it has been, for the most part, suspected herds which have been tested. Admitting that the greater part of these percentages are too high, we still have revealed a condition which is worthy of our serious consideration.

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[1] E. W. Hope (*The Lancet*).

The classes of animals most affected are breeding animals and dairy stock. The beef cattle coming to our markets are still singularly free from tuberculosis. Of 4,841,166 cattle slaughtered in the year 1900 under Federal inspection, but 5279, or 0.11 per cent. were sufficiently affected to cause the condemnation of any part of the carcass. Of 23,336,884 hogs similarly inspected, 5440 were sufficiently affected to cause condemnation of some part of the carcass. This is equal to 0.023 per cent., or slightly more than one-fifth the proportion found in beef cattle. It is scarcely necessary to add that there are certain lots of cattle and hogs encountered which are affected in much greater proportion than the general average just given.

From a recent view by Drs. Russell and Hastings, of the Wisconsin Agricultural Experiment Station,[1] of the *tests of cattle for tuberculosis* made in the United States, the following summary is presented:—

TABLE No. 20.

	Number Tested.	Number Tuberculosis.	Per cent. Tuberculosis.
Vermont	60,000	2,390	3.9
Massachusetts	24,685	12,443	50.0
Massachusetts, entire herds	4,093	1,080	26.4
Connecticut	6,300	. . .	14.2
New York, 1894	947	66	6.9
New York, 1897-98	1,200	163	18.4
Pennsylvania	34,000	4,800	14.1
New Jersey	22,500	. . .	21.4
Illinois, 1897-98	929	. . .	12.0
Illinois, 1899	3,655	560	15.32
Michigan		. . .	13.0
Minnesota	3,430	. .	11.1
Iowa	873	122	13.8
Wisconsin—			
Experiment Station tests:			
Suspected herds	323	115	35.6
Non-suspected herds	935	84	9.0
State Veterinarian's tests:			
Suspected herds	588	191	32.5
Tests of local veterinarians under State Veterinarian on cattle intended for shipment to States requiring tuberculin certificate	3,421	76	2.2

The following suggestions, adapted from the fifty dairy rules of the United States Department of Agriculture, are recommended for strict adoption in our dairies:—

The Stable.—Keep dairy cattle in a room or building by themselves. It is preferable, when possible, to have no cellar below and no storage loft above. The stables should be well ventilated, lighted, and drained; should have tight floors and walls and plainly constructed. Store the manure under cover outside the cow stable, and remove it to a distance as often as practicable. Whitewash the stables once or twice a year; use land plaster in the manure gutters daily. Clean and thoroughly air the stable before milking; in hot weather sprinkle the floor.

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[1] Bulletin No. 84, Wisconsin Agricultural Experiment Station, March, 1901.

The Cows.—Have the herd examined at least twice a year by a skilled veterinarian. Promptly remove from the herd any animal suspected of being in bad health and reject her milk. Never add an animal to the herd until certain it is free from disease, especially tuberculosis. Do not allow the cows to be excited by hard driving, abuse, loud talking, or any unnecessary disturbance. Feed liberally, and use only fresh, palatable food stuffs. Provide water in abundance, easy of access, and always pure. Do not allow any strongly flavored food, like garlic, cabbage, turnips, to be eaten except immediately after milking. Clean the entire body of the cow daily. If the hair in the region of the udder is not easily kept clean, it should be clipped. If the sides of the cow are plastered with dirt or manure, as is often the case, a certain amount is sure to fall into the pail of milk. This is where the trouble really begins, for this dirt and manure abound in bacteria which cause decomposition in milk, and thereby induce bowel disturbances.

The Milk.—The milker should be clean in all respects. He should wash and dry his hands and clean his nails just before milking. After the hands have been washed, a little vaseline may be used on them, thereby preventing scales from the teat or fingers getting into the milk. The milker should wear clean, dry garments, used only when milking, and kept in a clean place at other times. Brush the udder and surrounding parts just before milking, and wipe them with a clean, damp cloth or sponge. Commence milking at the same hour every morning and evening, and milk quietly and thoroughly. Throw away (but not on the floor—better in the gutter) the first few streams from each teat. This first milk is watery and of little value, and during the intervals between milking, the bacteria from the air get into the cow's teats and grow with great rapidity. These bacteria cause early souring of the milk. If in any milking a part of the milk is bloody or stringy or unnatural in appearance, the whole mass should be rejected. Milk with dry hands, or oiled as above; never allow the hands to come in contact with the milk. If any accident occurs by which the pail, full or partly full, of milk becomes dirty, do not try to remove this by straining, but reject all this milk and rinse the pail.

Care of the Milk.—Remove the milk of every cow from the dairy at once to a clean, dry room, where the air is pure and sweet. Do not allow cans to remain in stables while they are being filled. Strain the milk through a metal gauze and a flannel cloth, or layer of cotton, as soon as it is drawn. Aerate and cool the milk as soon as strained. The rapid aeration and cooling of milk are matters of great importance. Combined aerators and coolers, suitable for use with well water or ice water, can be had at any diary supply house at a small cost. By using one of these, the cow odor, the animal heat, and much of the dirt can be removed from milk in a few minutes. The milk should be cooled to 45° F., if for shipment, or to 60° F., if for home use or delivery to a factory. Never mix fresh, warm milk with that which has been cooled. Do not allow the milk to freeze. When cans are hauled a distance they should be full and carried in a spring wagon. In hot weather cover the cans, when moved in a wagon, with a clean, wet blanket or canvas. If milk is stored, it should be held in tanks of fresh, cold water, renewed daily, in a clean, cold, dry room. Clean all dairy utensils by first thoroughly rinsing them in warm water; then clean inside and out with a brush and hot water into which a cleansing material is dissolved; then rinse, and lastly sterilize by boiling water or steam. Use pure water only. After cleaning, keep the utensils inverted in pure air and sun if possible, until wanted for use. Old cans, in which parts of the tin are worn off, or where there are seams and cracks, are impossible to keep clean, and should not be employed.

Small Animals.—Cats and dogs must not be in the stables during the time of milking. The reason for this is that cats are peculiarly liable to transmit diphtheria; both cats and dogs have disgusting skin diseases which may be transmitted to children, and both animals also are apt to nose around and dirty the utensils.

If precautions like the above are strictly carried out, the milk will be clean and remain fresh for a considerable length of time. The fresher the milk is, the better it will be for family use. *The test for uncleanliness consists in an increase in the proportion of lactic acid generated in the milk, and in a large increase in the number of bacteria per cubic centimeter.*

The New York Senate passed a bill recently, forbidding sale of milk containing formaldehyde or salicylic acid, owing to their injurious effects on infants.

RAW MILK.

Monrad (*Jahrbuch f. Kinderheilkunde,* No. 55, p. 61) describes a series of children fed with raw milk. These infants could not digest sterilized or boiled milk. Their condition improved when raw milk was substituted. It was interesting to note that during the course of Monrad's investigations an infant received sterilized milk by mistake, and its former dyspeptic symptoms reappeared.

Jensen found that new-born calves assimilated raw milk, but when boiled milk was given, they were subject to coli-enteritis. Such calves that recovered were atrophic. Milk, when subjected to prolonged sterilization, such as tyndalizing the milk, undergoes certain chemical changes. These are:—

1. Nuclein and lecithin are rendered insoluble.
2. Milk-sugar is completely changed.
3. The coagulability of the casein is impaired.
4. The fat globules are separated and rise to the surface of the milk.

TABLE NO. 21.—*Milk Preservatives and Their Actions.*[1]

Preservative Used.	Grains of Preservatives Used per Gallon of Milk.	After Standing 2 Days.	After Standing 4 Days.	After Standing 6 Days.	After Standing 7 Days.	After 8 Days. Lactic Acid, Per Cent.	After 11 Days. Lactic Acid, Per Cent.
(Pure Milk)	. . . .	Distinctly turned	Slightly Sour	Sour	Sour and curdled	0.68	0.71
Formic aldehyde (40 per cent.)	8.75 0.0125 per cent.	Sweet	Sweet	Sweet	Sweet	Sweet 0.12	Sour and Curdled 0.43
Formic aldehyde (40 per cent.)	17.5 0.025 per cent.	Sweet	Sweet	Sweet	Sweet	Sweet 0.10	Sweet 0.14
Formic aldehyde (40 per cent.)	35 0.05 per cent.	Sweet	Sweet	Sweet	Sweet	Sweet 0.07	Sweet 0.10
Boric acid	35 0.05 per cent.	Sweet	Sweet	Turned	Sour and curdled	0.42	0.52
Boric acid and borax (calculated to boric acid)	35 17.5 of each.	Sweet	Sweet	Sweet	Sweet	Sweet 0.10	Sour 0.32
Salicylic acid	17.5 0.025 per cent.	Sweet	Sweet	Sweet	Turned	Sour 0.26	0.42
Salicylic acid	35 0.05 per cent.	Sweet	Sweet	Sweet	Sweet	Sweet 0.10	Sour 0.33
Benzoic acid	17.5 0.025 per cent.	Sweet	Sweet	Slightly turned	Sour	Sour 0.45	0.52

[1] Tests for determining adulterations in milk will be found in Part XII.

5. By the influence of the chlorides on the casein peptones are formed in the milk.

6. The milk is rendered unpalatable by this superheating.

7. The albumin is rendered much less assimilable by prolonged heating.

The increased number of cases of rickets and Barlow's disease since the advent of sterilization do not speak well for this process.

Certain factors should be noted:—

1. That sterilization is intended to kill pathogenic bacteria in the milk.
2. That not only are pathogenic bacteria destroyed, but also saprophytes, which certainly have some bearing on the digestive functions of an infant.

We know that the proteolytic bacteria are in the milk for certain reasons:—

1. To coagulate the casein.
2. To peptonize this coagulated casein.

It is possible that by sterilizing milk and destroying these bacteria, we rob the milk of microbes necessary to perform certain aids in the digestive process.

Such assistance in the digestion of milk may not be necessary in the robust and normal infant, but it is quite different when we are dealing with dyspeptic or atrophic infants.

When infants *thrive on sterilized milk,* then it is a good plan to *continue the same;* but if *dyspeptic symptoms—vomiting* and *undigested, cheesy stools* with colicky symptoms—show themselves, then such food should be discontinued. Such cases demand a *radical* change of diet, and it is here that an easily assimilated form of food is indicated. *Such food is raw milk.*

Scorbutic cases in which we *continue* giving sterilized milk will not be modified whether we add HCl, pepsin, or alkalies. The character of the food is at fault and a radical change must be made. For the *treatment of atrophy nothing will supersede raw milk.* Certain precautions must be taken in securing raw milk for infant feeding.

The ideal cows' milk is clean, raw milk. By this is meant *milk free from all possible contamination.* Such milk should be obtained from a stable having all modern hygienic surroundings. If greater attention were bestowed on the condition of the cow, the cow's udder, the stable, the bucket, the hands of the milker, then less sterilization and pasteurization would be necessary. Let it be distinctly understood that certain chemical changes are brought about in milk when it is steamed, be it in the process of sterilization or pasteurization. *Neither sterilization nor pasteurization adds to the digestibility of milk.* Indeed, chemical experience has demonstrated the fact that raw milk, sold in some places as certified milk, in the Walker-Gordon milk laboratories as guaranteed milk, is more easily assimilated. It is proven by the condition of the stools as well as the gastric digestion.

Nature has given us a good example of how milk should be fed to an infant. *Breast-milk is certainly raw milk,* and is served to the infant at the temperature of the body. Not only does boiling and steaming of milk produce chemical changes in the albuminoids, but it renders the process of digestion much more difficult, and thus it is that most infants taking boiled milk suffer with constipation. This is not so, however, in the case of infants fed on raw milk.

When sterilized and pasteurized milk are found to disagree with children, raw milk may sometimes be easily assimilated. Thus it will be found that, while boiled milk, or sterilized or pasteurized milk, given either whole or with its proper dilution to suit the various ages, will provoke constipation, by substituting raw milk for heated milk the same will be more easily assimilated. The author has frequently noted decided antiscorbutic properties in fresh raw milk. In children with pronounced rickets, and even scurvy, the withdrawal of sterilized or other milk and the substituting of fresh raw milk will work surprising changes.

Biedert[1] states that he has followed Escherich and Epstein, who recommend giving full milk to children at birth. In France, Budin and H. de Rothschild, and more recently E. Schlesinger, in Germany, have given undiluted milk to both sick and well children as a substitute for breast-milk. Biedert claims to have seen good results in some instances, but cannot recommend whole milk, as a rule, for feeding children. Marfan, another advocate of pure-milk feeding, believes that milk should be diluted until the fourth or fifth month, but later he advises pure-milk feeding. Schlesinger, of Breslau, while giving pure milk, gives a longer interval between the meals. That the greatest possible success is not achieved by this method in France can be judged by the statement of Marfan while discussing the subject of athrepsia. He says: *"N'a jamais vu l'athrepsie confirmée se terminer favorablement."* Thus it seems that even we have much better results than the French, for there are certainly a great many children who can and will digest a diluted milk, and thin milk-and-cream mixtures, as shown by their stool, their sleep, and their increase in weight. These same children with enfeebled digestive functions will invariably show gastric disturbances—such as vomiting, colic, constipation, or diarrhœa, restlessness, sleeplessness—and will cry continually when given whole milk. So that *whole milk-feeding* is not assimilated during the early months of a child's life; besides they do not increase in weight. This method of feeding has been tried over and over again, and we are compelled to discontinue the heavier food, consisting of whole milk, and substitute a light food, consisting of diluted milk.

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[1] Fourth Edition of Kinderernährung, 1900, page 184.

Fresh Raw Milk.—Just as the medical profession, and to some extent the laity, have become impressed with the idea that milk should be boiled before being used, to insure the destruction of the microbe which it contains, Dr. Freudenreich comes forward with a series of experiments, by which he claims to prove that raw milk possesses remarkable germicidal properties. According to his experiments, the bacillus of cholera, when put into fresh cows' milk, dies in one hour, the bacillus of typhoid fever succumbs at the end of twenty-four hours, while other germs die at the end of varying periods.

Milk which has been exposed to a temperature of 131° F. loses its germicidal properties. Milk which is four or five days old is also devoid of microbe-killing power.[1]

Undiluted Milk as a Food for Infants.—Notwithstanding tireless research and wonderful ingenuity, a perfect substitute to replace mother's milk as an article of food for the nourishment of infants yet remains to be discovered. This is greatly to be regretted, as the occasions are not rare on which mothers' milk is not available, or it is desirable or even necessary to have recourse to such a substitute. The fact is that there is yet not a little to learn concerning the assimilative processes in children, and knowledge, particularly of a practical character concerning food, is not so extensive or so precise as it might be. As K. Oppenheimer points out in a recent communication, an article of food for the infant to serve as a perfect substitute for mother's milk should be as useful as the latter in the nourishment both of healthy children and of those suffering from gastro-intestinal catarrh. These requirements, however, are not met by any of the large number of artificial foods that have been devised. For the purpose of establishing the usefulness of undiluted cows' milk as judged by this standard, Oppenheimer made comparative observations in normal healthy children, in infants suffering from gastro-intestinal derangement, and in atrophic children. In almost all of the 11 cases of the first group the body weight exhibited a steady and uniform increase; while of 36 cases of the second group only 6 failed to do well; and of 12 cases exhibiting marked atrophy 8 failed to do well. All of the foregoing cases were under observation for periods of more than four weeks. Of 33 additional cases under observation for a shorter period than four weeks, 20 thrived and 13 did not.

The Dangers.—We naturally regard the dangers of having tubercle bacilli in the milk as one of the prime reasons for sterilizing the same. No physician will use milk unless the animal has been tested with tuberculin. We should never employ the milk from *one cow*, but always from a *mixed herd.*

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[1] Bacteriological World. December, 1891; Journal of the American Medical Association, February 27, 1892.

The danger of transmitting tuberculosis is certainly very rare. Authentic cases have been reported from time to time in medical literature in which a supposed infection could be attributed to milk. R. Koch disputes the possibility of transmitting bovine tuberculosis to man.

In a herd of cows which has undergone the *proper veterinary inspection, the danger of overseeing tuberculosis of the udder is reduced to a minimum.* When the udder of a cow has tubercular disease, then, naturally, the danger of infection exists. We must not forget that there are a great many pathogenic bacteria and their spores, which are far more dangerous to the infant than tubercle bacilli.

CHEMICAL EXAMINATION OF COWS' MILK.

FAT.[1]

The fat required for an infant fed on cows' milk is about 1 per cent. on the second day after birth. If the child is normal we can usually give it 2 per cent. at the end of the first week; 2 per cent. of fat is usually sufficient for the first month. Some children can do well with a feeding mixture containing this amount of fat for the first two months, while other children of the same age, but with better digestive functions, can assimilate 3 per cent. of fat at the end of the first month. During the second month children usually digest 2 $^1/_2$ per cent. of fat. At three months we can order 3 per cent. if normal conditions exist. It must be remembered that the average cows' milk contains about 4 per cent. of fat, and the writer does not imply that whole milk must necessarily be given. The guide for the increase of fat should always be the "scales." When an infant's weight remains stationary then the percentage of all ingredients should be increased.

In order to increase the fat it is necesary to add a definite quantity of cream. Three-fifths of the ordinary cream consists of fat. To correct hard, dry scybala we must increase the percentage of fat. A point therefore to remember is, *that constipation can be modified to a certain extent* by the addition of fat. Codliver-oil is frequently ordered as a corrective for constipation. It is useful chiefly for the amount of fat that it adds to the food.

Excess of Fat.—Excess of fat is indicated by the frequent regurgitation of food in small quantities, usually one or two hours after feeding. Sometimes an excess of fat causes very frequent passages nearly normal in appearance. In some cases the stools contain small, round lumps somewhat resembling casein, but really masses of fat. This has already been mentioned in speaking of the differentiation of true casein curds and small, fat lumps by the solubility of the latter in alcohol or ether.

FAT DIARRHŒA.—Biedert and Demme have devoted considerable attention to this subject. (See Biedert: "Fett-Diarrhae," in *"Jahrbuch für Kinderheilkunde,"* 1878). In some children the fæces showed 50 to 60 per cent. of fat, whereas the normal percentage in ordinary fæces varied from 13.9 per cent. (which is the normal quantity) according to Uffelmann.

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[1] Read also chapter on "Cream."

Babcock's Milk Test.—In this country the so-called Babcock Milk Test, invented by Dr. S. M. Babcock, has been adopted in preference to other practical milk tests, in creameries and cheese factories as well as in milk laboratories. The cause of the general adoption of this test is doubtless to be found in its simplicity, cheapness, and ease of manipulation. Briefly stated, the test is operated as follows: 17.6 cubic centimeters of milk is measured into a special milk-test bottle, an equal quantity of commercial H_2SO_4 (specific gravity, about 1.83) is added, and after mixing the two liquids, the test bottle is placed in a centrifugal machine and whirled for four minutes; hot water is then added to the bottle to bring the fat into graduated narrow neck of the bottle, and after a second whirling of one minute, the per cent. of fat in the milk is read off from the scale of the test bottle.

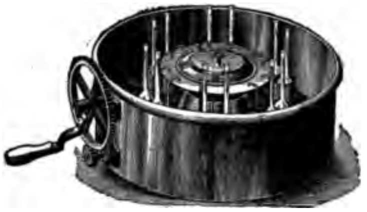

Fig. 35.—Centrifugal Testing Machine, for Handpower.

A determination of fat in milk by this method takes less than fifteen minutes, and when care is taken in sampling the milk and reading of the result, is accurate to within one-tenth of 1 per cent. Babcock testers are now placed on the market by many manufacturers of dairy supplies and at a remarkably low price, thanks to sharp competition among the manufacturers. The testers are either hand or power (steam or motor) machines and built to hold from two to thirty or more test bottles at a time. The number of revolutions at which they must be run ranges from 800 to 1200 per minute, according to the diameter of the testers.

The Determination of Fat.—The simplest method is by the cream gauge (Fig. 36). Although its results are only approximate, they are in most cases sufficiently accurate for clinical purposes. The tube is filled to the zero mark with freshly drawn milk, which stands at a room temperature for twenty-four hours, when the percentage of cream is read off. The ratio of cream to fat is approximately 5 to 3, thus 5 per cent. cream represents 3 per cent. fat, etc.

Another rapid method is by Marchand's tube.

Marchand's Test.—First put into the tube five cubic centimeters of milk, up to the line *M*; then four or five drops of liquor sodæ; shake; add five cubic centimeters of ether, up to the line *E*. Cork, and shake fifteen or twenty times; add 90 per cent. alcohol, up to the line *A*. The tube is now tightly corked, shaken thoroughly, and placed upright in a tall bottle containing water at a temperature of 120° to 150° F. The fat separates and forms a distinct layer at the top, and after half an hour the amount is read off in degrees. By reference to the following table the exact percentage of fat is shown:—

TABLE NO. 22.

Degrees, Marchand.	Percentage of Fat.	Degrees, Marchand.	Percentage of Fat.
1	1.49	13	4.29
3	1.96	15	4.75
5	2.42	17	5.22
7	2.89	19	5.68
9	3.36	21	6.14
11	3.82		

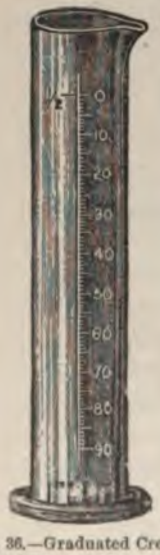

Fig. 36.—Graduated Cream Gauge, 10×1½.

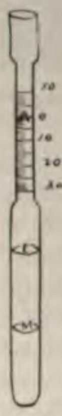

Fig. 37.—Marchand's Tube.

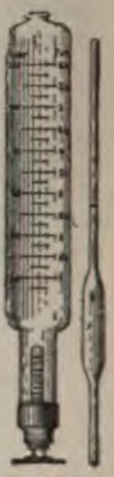

Fig. 38.—Feser's Lactoscope.

Each additional degree on the tube corresponds to 0.23 per cent. of fat. To insure accuracy the test should be repeated two or three times with the same specimen.[1]

Another test is made by the use of Feser's Lactoscope. (See Fig. 38.) The test is made as follows: Four cubic centimeters of milk are measured off in a pipet, put into a tube, and water slowly added, shaking from time to time until the black lines of the porcelain stem at *A* are clearly visible through the mixture of milk and water. The percentage of fat is then read off on the glass cylinder at the level of the water added; thus, if the water is to the mark 4, it indicates the presence of 4 per cent. of fat. This test is only applicable to cows' milk.

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[1] These tubes may be obtained from E. Greiner, 51 William Street, New York.

It seems to be pretty well settled that the fat in woman's milk usually varies between 3 and 5 per cent., the sugar between 4 and 8 per cent., proteids (albumin and casein) between 1 and 2 per cent., and the ash between 0.2 and 0.4 per cent., the water being about 88 per cent. Wide extremes are met with; so it is useless to think of woman's milk as of a certain composition.

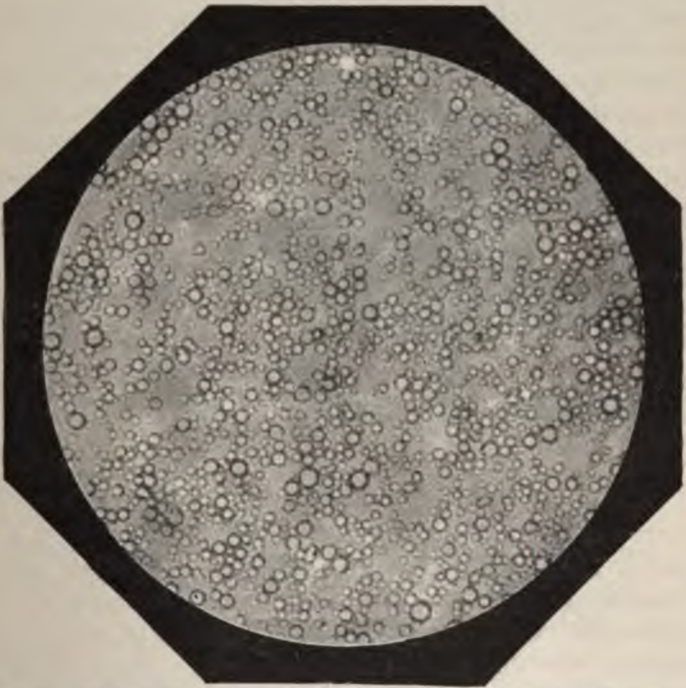

Fig. 39.—Cows' Milk, Showing Fat-globules, Magnified 330 Diameters.

MILK SUGAR OR LACTOSE.

Milk sugar being normally found in breast-milk has been advocated by very many writers. Soxhlet and Heubner in Europe; Holt and Rotch, in America, advocate the use of milk sugar in infant-feeding. Jacobi and Fischer,[1] among others, prefer cane sugar.

Cane Sugar.—Cane sugar has been employed in commerce as a means of preserving food and milk. It certainly possesses antibactericidal properties. Brush made a series of experiments with the milk sugar of commerce, and found that the urine of babies fed on milk to which milk sugar was added, invariably excreted the sugar by the kidneys and bowels. The urine of such infants contained sugar when examined by Fehling's Test. It is interesting to note that babies fed on milk mixture containing milk sugar, always give a sugar reaction in the urine.

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[1] See Infant Feeding. Louis Fischer. Third Edition, page 139.

Bernard has shown that 7 grains of milk sugar dissolved in 1 ounce of water, could be injected under the skin of a rabbit without giving a reaction of sugar in the urine.

The reverse was true when cane sugar was tried. Hence the conclusions are the exact opposite of those given by Brush. The urine of breast-fed babies did not, when examined, give a positive reaction. Thus it proves that milk sugar in the human breast-milk, when given to an infant, is readily assimilated, whereas milk sugar of commerce is only partly assimilated and partly excreted.

TABLE No. 23.

Comparative Average.	Woman's Milk. Per Cent.	Cows' Milk. Per Cent.
Fat	4.00	3.50
Proteids	1.50	4.00
Sugar	7.00	4.30
Salts	0.20	0.70
Water	87.30	87.50
	100.00	100.00

Albert R. Leeds[1] states that all the samples of powdered milk sugar coming from drug stores, examined by him, were contaminated. When the sugar was dissolved in sterile water and a gelatine peptone culture was made, bacteria invariably were found. Hence the conclusion that milk sugar, as it is commonly found in the shops, is not safe for infant-feeding.

The nutrient value of sugar is certainly overestimated. We know, according to chemists, that carnivorous animals do not secrete sugar to any appreciable extent. That sugar is not a necessary element of food can be seen by the fact that canines secrete no sugar in their milk, and still a small slut can nurse seven or eight puppies and keep them all fat. Condensed milk is certainly made up chiefly of sugar. We all know that infants reared on this food have rickets more readily and succumb to gastro-intestinal and infectious disorders more easily than infants on any other form of feeding.

Escherich states that the bacillus lactis aërogenes is normally present during digestion. It acts on the milk sugar to produce an organic acid which drives out the more noxious forms of bacteria, which by their presence would interfere with normal digestion.

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[1] Journal of American Chemical Society.

When milk sugar is converted into glucose and galactose, we physiologically have a gradual conversion into lactic acid, which may aid in the digestion of the proteids, thus giving us a very valuable addition to the means at our command for rendering modified cows' milk digestible (Rotch).

Sugar is too Low.—If the sugar is too low the gain in weight is apt to be slower than when furnished in proper amount.

Sugar in Excess.—Symptoms indicating an excess of sugar: Colic or thin green very acid stools, sometimes causing irritation of the buttocks; sometimes there is regurgitation of food and eructations of gas.

THE PROTEIDS.[1]

The proteids are one of the most, if not the most, important constituents of milk. Deficiency of proteids means retarded development. The proteids have always been regarded as the backbone of food. They have a group of closely related substances which are perhaps modifications of the same body. The proteids are the albuminous compounds.

According to Pavy the nitrogenous compounds are mainly "histogenetic" or tissue-forming material. By the separation of urea which occurs in this metamorphosis in the animal system, a hydrocarbonaceous compound is left which may be appropriated to heat production.

When we examine the proteids of human milk, we find that the analysis shows:—

TABLE No. 24.

Human Milk.	*Cows' Milk.*
Caseinogen...Small Amount	Caseinogen...Large Amount
Lactalbumin..Large Amount	Lactalbumin..Small Amount

In *human milk* König finds the *lactalbumin is about two-thirds* ($^2/_3$) and the caseinogen about one-third ($^1/_3$) of the total proteids. In *cows' milk* the *lactalbumin is only one-sixth* ($^1/_6$) to five-sixths ($^5/_6$) caseinogen.

Rotch, reasoning from this standpoint, advises, in writing a prescription which calls for a total proteid of 1 per cent., that we should calculate to have 0.75 per cent. lactalbumin and 0.25 per cent. caseinogen.

A prescription calling for fat, 3 per cent.; sugar, 6 per cent.; proteid, 1 per cent.; alkalinity, 5 per cent., would be written as follows:—

	Per Cent.
℞ Fat	3.00
Sugar	6.00
Proteids (total)	1.00
(*a*) Lactalbumin	0.75
(*b*) Caseinogen	0.25

Number of feedings	9
Amount at each feeding	75 c.c. (℥2 $^1/_2$)
Infant's age	3 weeks
Infant's weight	9 pounds
Alkalinity	5 per cent.
Heat at	155° F.

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[1] See also article Laboratory Modification, page 173.

It is to be noted that although the total proteid percentage in the milk for an infant may be considerably increased, it is these higher percentages which are the most irrational in their nutritive values in the early months of infancy, if we hold to the rule that the caseinogen should be only one-third of the total proteids. This ratio of lactalbumin to caseinogen can be obtained if we are writing for a low proteid, as in the above prescription, or in a prescription calling for a total proteid percentage of 0.75, of which 0.25 per cent. shall be caseinogen and 0.50 per cent. lactalbumin. If, on the other hand, we write for a high total proteid, such as 3 per cent., the highest percentage of lactalbumin that can be obtained is 0.85, and the remaining 2.15 per cent. is caseinogen, which practically reverses our ratio, making the caseinogen over two-thirds ($^2/_3$), and the lactalbumin less than one-third ($^1/_3$).

It can be said, however, that as the infant grows older its power to digest casein becomes proportionately greater, so that in the later months of infancy, the tenth, eleventh, and twelfth, its proteolytic function has become adapted to this change in the ratio of the caseinogen and lactalbumin, so that the higher total proteids, such as 2.50, 3, 3.50, and finally 4 per cent., with the relatively high caseinogen and low lactalbumin, become the proper nutritive portion for the infant.

The point especially to be emphasized is that in the early months of life, which demand a low proteid percentage, we can by the use of whey obtain, in a modified milk, the same proportions of lactalbumin and caseinogen which we find in human breast-milk at a corresponding period of infancy.

Split Proteids in Infant Feeding.—Little is known either here or abroad of the physiologic difference between the proteids of cows' milk and of human milk. It is of great advantage to be able to approximate the proportion of whey proteid to caseinogen in preparing artificial foods.

In an address before the British Medical Association (*Br. Med. Jour.*, Sept. 6, 1902) Rotch said that this use of the split proteids, which has been introduced largely through the experiments of White and Ladd, was probably the most important step in advance taken in recent times.

Their conclusions were as follows:—

1. By the use of whey as a diluent of creams of various strengths, cows' milk can be modified so that its proportions of caseinogen and whey proteids closely correspond to those in human milk.

2. The whey must not be heated above 69.3° C. or its proteids coagulate; 65.5° C. destroys the rennin enzyme.

3. The emulsions of fat in whey, barley water, gravity cream, and centrifugal cream mixtures were the same; and though the combination of heat and transportation may destroy the emulsion in any modified milk, this may surely be prevented by keeping the milk cool during delivery.

4. Whey-cream mixtures yield a much finer, less bulky, and more digestible coagulum than plain modified mixtures with the same total proteids. It is clear that the use of barley water, which gives the next finer coagulum, is not indicated. The tenacity of the whey coagulum is not influenced by the proportion of fat present, and whey, while not so important in its mechanical action in affecting the coagulum as the cereal diluents, still had a pronounced power in that direction. In very young infants the total proteid should be above 0.75. Of this 0.50 should be whey albumin and 0.25 caseinogen. When the infant has reached an age where it requires a higher total proteid than 1.75, on account of lack of chemical knowledge, we must begin to give whole proteid.

Proteids in Excess.—Proteids in excess are indicated by the presence of curds in the stools. This is the most frequent cause of colic in infants. Sometimes there is diarrhœa, more often constipation when the proteids are in excess. This excess of proteids frequently causes vomiting, and so does an excess of both fat or sugar. If, therefore, after reducing the percentage of proteids, fat, and sugar, vomiting still persists, then we must feed the baby with smaller quantities. Thus we may have to give a 4-ounce bottle where a 6-ounce or a 5-ounce feeding causes vomiting. Certain rules can be laid down; if an infant does not thrive, *i.e.*, does not gain in weight without showing any signs of indigestion, then the proportions, *i.e.*, percentages of all ingredients, should be gradually increased, chiefly the proteids, however, for the latter is the most important element in an infant's food.

A Clinical Method for the Estimation of Breast-milk Proteids.[1]—"Two 'milk-burettes,' each containing 5 cubic centimeters of milk, are subjected to a temperature warm enough to rapidly sour the milk, and are allowed to remain in this warmth until a distinct precipitation can be seen. The burettes are then cooled in water, the milk-serum is withdrawn into the graduated tubes, 10 cubic centimeters of Esbach's solution (picric acid, 5 grams; citric acid, 10 grams; water, 500 cubic centimeters) are added, the tubes are shaken, and centrifugated until constant reading, and the resulting precipitate is read. This reading expresses in percentage the total amount of proteids in the milk.

"Such is a bare statement of the method. I will briefly take up the various steps in detail. The 'Milk-burettes' are made of about 10 cubic centimeters' capacity, and have a glass pinch-cock or valve and a narrow exit-tube about an inch long (Fig. 40).

"I have tried various forms of burettes and separating funnels, and find this the most satisfactory. A temperature of from 95° to 100° F. is the most rapidly effective to produce fermentation. This I have most conveniently obtained by placing the tubes in a burette-stand, and the stand in contact with a radiator. The time required to obtain a distinct precipitation of casein is from eighteen to twenty-four hours. At the end of this time the milk has distinctly separated into an upper layer of viscid yellow fat; a lower layer of fluid milk, quite opaque above, almost translucent below, and clinging to the sides of the tube, and especially at the bottom, a granular precipitate. The cooling of the milk increases the viscidity of the fat and facilitates its separation from the milk-serum. The milk-serum is received into 15-cubic-centimeter graduated tubes, the solution of picric acid and citric acid added up to the 15-cubic-centimeter mark, the mixture stirred with a glass rod and placed in the hand-centrifuge. The amount of centrifugation required is in direct proportion to the care used in separating the fat. If fermentation be watched and the separation be made as soon as the casein-precipitate is distinctly present, the centrifugation to a constant reading may be quickly accomplished."

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[1] Reprinted in large part from George Woodward's article in the Phila. Med. Journal, May 21, 1898.

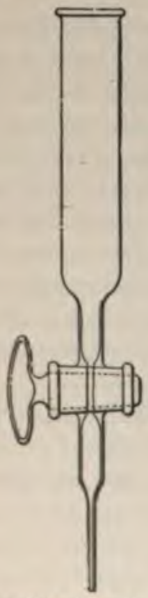


Fig. 40.—Woodward's Burette for Estimating Proteids.

"According to Schlossman, of the albuminoids in woman's milk, 63 per cent. are casein, 37 per cent. lacto-albumin, the latter of which is absorbed directly. There is, moreover, according to Wroblewski, in the human milk another proteid rich in sulphur, poor in carbohydrate, and according to some, albumoses and peptones, that also would be directly absorbable.

Of nucleon (v. Wittmaack and M. Siegfried, Zeitsch. f. phys. Chem. xxii), there is contained in cow's milk 0.057, in goat's milk 0.110, and in woman's 0.124 per cent. In cow's milk the phosphorus of the nucleon amounts to 6 per cent. of the total amount of phosphorus contained in the milk, in woman's milk 41.5 per cent. That explains why good cow's milk with its inorganic phosphates may give a baby rachitis, while good breast milk does not do so at all." (A. Jacobi, Pediatrics, Nov. 1, 1900).

Curdling of Milk and Diluents.—Milk of all animals may be separated into two classes, those that form a soft curd with rennet and those that form a hard curd with rennet. Woman's milk is in the first class and cows' milk in the second.

The conditions favorable for the formation of hard curds of cows' milk are body heat and the presence of rennet and lactic or other acid.

The rennet forms a clot of the milk, the heat causes the lactic bacteria to grow in the curd, and the acid causes the curd to shrink and become leathery. Adding alkalies to the milk neutralizes the acid, but the bacteria will keep making more lactic acid as long as any sugar is present.

Diluting milk with water does not prevent tough curds forming, but diluting with gruels does prevent the contraction of the curds. This has been proved beyond dispute, both experimentally and clinically.

Albuminoids in Cows' Milk.

That there are differences in the amounts of the albuminoids occurring in human milk is proven by the fact that, while Professor Leeds found a variation of 0.85 to 4.86, Professor Meiggs asserts that there was but 1 per cent.

König, an earlier analyst, makes the variation from 0.85 to 4.86. Some of these results give as high a percentage of albuminoids in woman's milk as we find in cows' milk, and I have no doubt in my own mind that the time and habit of extracting the milk has a deal to do with the amount of occurring albuminoids. In other words, when milk is extracted every two hours or less, it cannot contain as much of the cell-material as milk from the same source extracted at intervals of twelve hours. This latter is riper and it is the non-conformity of the tissue which causes all the difference in the different occurring albuminoids. We know that during the incubation of eggs casein is developed from egg-albumin. This illustrates the ripening of albumin. Furthermore, take an egg just laid by the hen, and boil it, and you will find immature albumin in it; that is, after boiling, instead of being thick and firm, like an older egg, much of it is milky. If boiled a few hours later, all the albumin will coagulate perfectly, because it has had time to ripen. There is no doubt that the albuminoids in milk from healthy animals are all cell-transformations, not an exudate, as are undoubtedly the fats and salts, because these latter we can influence by the food very plainly, but in health the albuminoids are constant without regard to food, while during menstruation, pregnancy, and other conditions, notably febrile disturbances, we find the fats and salts not materially affected, but the albuminoids decreased, increased, or totally changed, as in the case of colostrum. *The casein, besides being riper in cows' milk,* by reason of its stronger growth, is intended by Nature to coagulate into a hard mass, because it is the product of a cud-chewer for the nourishment of a cud-chewer, and the reason why it does not always coagulate in the infant's stomach as it does in that of the calf is that the latter animal's stomach secretes a principle called *chymosin;* this is the principle that curdles cows' milk, and it operates either in an acid or an alkaline medium. *Pepsin will not coagulate milk,* and hence the *hard coagulum of cows' milk* that sometimes forms in the infant's stomach is due to *acidity of that organ,* and this acidity is not always the fault of the stomach, *but of the milk itself.* The variations in the chemistry of the albuminoids found in cows' milk would not be surprising to anyone if he would examine into the condition of some of its mammary sources. Thus it will often be found, on *dissecting a cow's udder,* that there are *old cicatrices,* one or more quarters of the udder intensely inflamed, sometimes a mammiferous duct clogged with a calculus or a clot of fibrin. Besides these pathological conditions, the mammary gland is subject to benign and malign infiltrations, bacillary tubercular deposits, and eruptive diseases of the skin involving the gland and ducts. Therefore, that fibrin, serum, and albumin, in various forms, are found in the cows' milk is not surprising, and it can safely be assumed that any variation in the albuminoids from the normal casein can be ascribed to sickness on the part of the animal.

SALTS.

We next come to the salts contained in milk, and it is remarkable how few analyses have been made to determine the salts or minerals that are contained in this fluid. Heidlen's analysis, copied everywhere, seems to be the only exhaustive one of the salines in cows' milk made during the past century. It seems to me in this case, too, that it is time for the chemist to teach us something more. "There probably never was a time, in our era, at least, when milk was attracting so much attention as now, and still all our chemists are content with the total solids, fats, albuminoids, and sugar—just what the butter-makers and cheese-makers want to know. From this much-quoted analysis of cows'-milk salts we learn that milk contains in various proportions the phosphates of lime, magnesia, and iron; the chlorides of potassium, sodium, and iron; and free soda. Robin gets from human milk, in addition to the foregoing, carbonate of lime and soda, phosphate of soda, sulphate of soda, and potash. We have no means of knowing how constant is the occurrence of any of these salts in milk or under what conditions they are modified; we do know, however, from the experiments of Fehling, that many of the drugs administered to the *milking female are excreted in the milk.* Therefore, we can safely assume that the saline constituents occurring in milk are influenced both by the health and food of the animal. That the *phosphates are craved for by the milking cow* is evidenced by the habit of chewing old bones and the like, and that there is a lack of this element of food *is not to be wondered at* when we see *herds of milking cows pastured* on old, worn-out lands. The practical farmer knows that exhausted pasture-lands need, more than anything else for their rejuvenescence, the phosphates, and we know that in our nutrition we need them also. The land on which a cow is pastured will indicate pretty fairly what we may expect to find in her milk as salts. We have all noticed the excessive growth of sorrel on exhausted land. Can it then be a subject of wonder that some kind of a vegetable acid should be found in the milk of animals that are obliged to include this variety of food in their summer-rations and sour ensilage or spoiled brewery grains in their winter-feed? Theodore Hankel's discovery of citric acid in cows' milk to the amount of 0.9 and 1.1 grams per liter is just what might be expected."

Lime-salts in Cows' Milk.—Milk curdles under two entirely distinct sets of conditions: (1) it curdles on addition of an acid, and (2) it curdles under the influence of rennet (when the reaction of the milk is either neutral or slightly acid). The two varieties of curds which may be obtained under these circumstances may be denominated "acid curds" and "rennet curds," respectively. Acid curds must inevitably be formed in the stomach after milk has been drunk, if the gastric contents are allowed to become acid. Such curds (we are familiar with them in ordinary life in the form, for instance, of cream-cheese or sour-milk) are probably not sufficiently firm to set up digestive disturbances. On the other hand, rennet curds (such as we are familiar with in the form of renneted milk and of ordinary cheese) may be extremely firm. *It is, therefore, in all probability these rennet curds which set up the familiar infantile dyspepsia of bottle-fed children.* If this is so, the facts elicited by Arthus and Pages would appear to be of dominating importance in the treatment of these dyspeptic conditions. In order to appreciate this correctly the following facts must be attended to: (1) rennet-coagulation is delayed and curdling becomes less and less firm as an increasing proportion of the lime-salts of the milk becomes precipitated as insoluble salts; (2) addition of soluble lime-salts (up to a certain maximum) causes increased rapidity of rennet-coagulation, accompanied by increased firmness of clot; (3) human milk contains 0.03 per cent. of lime; (4) cows' milk contains 0.17 per cent. of lime (Bunge).

ENZYMES (EFFRONT AND PRESCOTT).

The enzymes, soluble ferments, zymases, or diastases are active organic substances, secreted by cells, and have the property, under certain conditions, of facilitating chemical reactions between certain bodies, without entering into the composition of the definite products which result. These substances play a very important part in the phenomena of assimilation and of dissimilation of foods. In fact, most of the foods which occur in Nature at the disposition of men, lower animals, or plants, are not directly assimilable; they require the intervention of a diastase in order to be transformed into substances assimilable and suitable for the formation of new tissues.

STARCH.

Starch, which serves in the nutrition of almost all living creatures, is not directly assimilable, and in the highest organism it undergoes various transformations before it can be absorbed. First of all, it encounters the enzymes of the saliva, then others in the pancreatic juice, and thus it is transformed into maltose and glucose, foods directly suitable for the construction of tissues. Meat, milk, and white of egg must also be transformed under the influence of the diastases before becoming assimilable. These substances find the enzymes which can act upon them in the gastric and pancreatic juices.

Transformation of Starch.—The cellulose is dissolved, the starch is transformed into maltose, part of which is oxidized, and part changed into cane sugar by the tissue of the seed. All these transformations, as well as the oxidation itself, are produced by the diastases secreted during germination.

One can follow the course of most of these transformations; for example, the solution and transformation of starch. For this purpose an embryo is separated from the grain and made to develop on a gelatinized must in which starch has been placed in suspension.

By observing the phenomenon very closely and by examining the starch under the microscope, one can see that the grain of starch loses its original form; that it is corroded in several places, and that it then liquefies and disappears. In the culture liquid one finds substances which did not exist before: a sugar, and a nitrogenous substance, the diastase, which is soluble, capable of precipitation by alcohol, and can itself produce a transformation of starch.

In the assimilation of albuminoid matter by cells, there occurs a phenomenon quite analogous to the assimilation of carbohydrates. The albuminoid substances are gradually transformed by the active substances of the cells into proteids, peptones, and finally into amides.

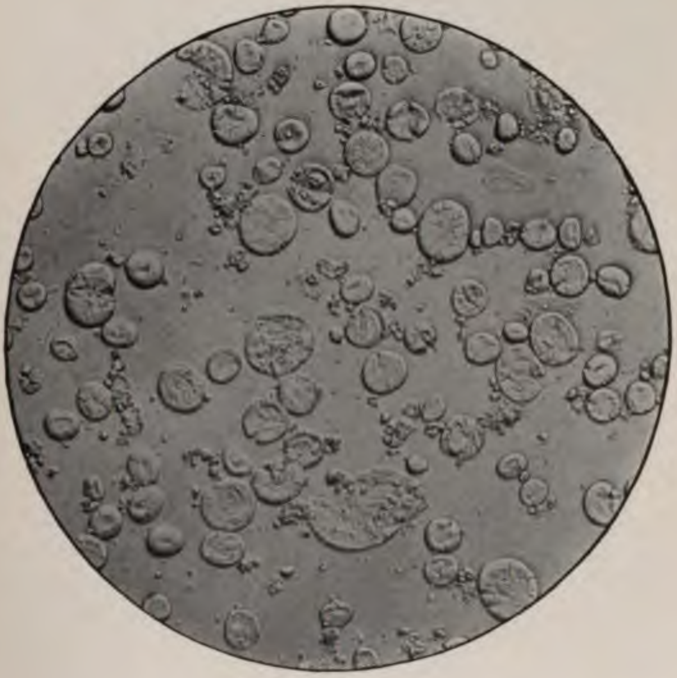
We have said above that the diastases play an extremely important part in the phenomena of dissimilation. The molecules of albuminoid substances, hydrated, decomposed, and transformed by the enzymes, are regenerated, in the presence of the protoplasm of the cells, by the process of dehydration and molecular condensation. The reconstructed molecules undergo new changes; they are again hydrated, decomposed, and at the same time gradually oxidized. In this phase of the transformation the albuminoid molecule is decomposed into urea, glycogen, fatty substances, and amides. These transformations are also due, in great part, to the active substances secreted by the cells.

Finally, the enzymes are powerful producers of heat; the reactions caused by the diastases are exothermic reactions.

Starch Digestion in Infants.—A. Jacobi says: "It has long been the custom to say that no amylaceous substances should enter into a young infant's food because it has from Nature at an early age no ferment capable of digesting starch. The saliva of a newly-born child—and it is wrong to say that there is no saliva at this age—will dextrinize starch, as any one who wishes may prove for himself."

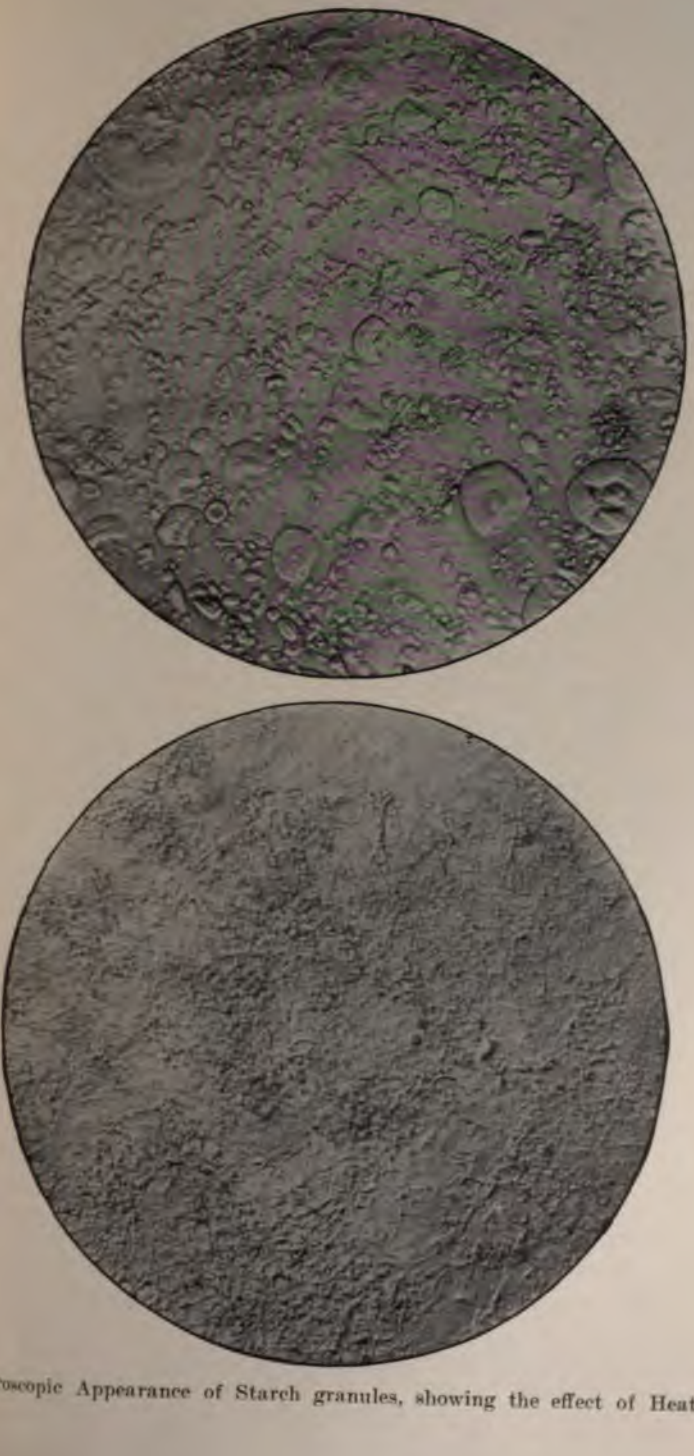
Chemistry of Starch Transformation.—In 1811 Vauquelin found that when starch was heated it was changed into a gummy substance soluble in

PLATE V



Microscopic Appearance of Raw Starch-granules.

PLATE VI



Microscopic Appearance of Starch granules, showing the effect of Heat.

water. Kirchof found that starch boiled with diluted sulphuric acid was converted into a sugar. In 1814 he found that a similar transformation of starch was brought about when the vegetable albumin of grain acted upon it. This transformation of starch was greatly intensified when the grain was malted. Stromeyer, in 1813, discovered the iodine reaction of starch. In 1819 De Saussure isolated the sugar produced by the transformation of starch and described its crystalline habit. Biot and Persoz, in 1833, gave the name of dextrin to the gum formed by the transformation of starch. Payen and Persoz gave the name of diastase to the agent in malted grain which transformed starch. Leuchs, in 1831, discovered that saliva changes starch into sugar. In 1845 Mialhe, in a memoir to the French Academy, announced the discovery and isolation of the ferment of saliva. This he called animal diastase. He demonstrated the action of malt diastase and the action of animal diastase of the saliva upon starch. The transformation by the former into dextrin, and the latter into sugar, was identical. It was regarded as one of the most important discoveries in chemical physiology. Mialhe, in 1845, suggested that since the action of malt diastase and of animal diastase upon starch was identical, malt diastase should be employed in solving the problem of artificial feeding of infants. The action of diluted acid upon starch transforms it into dextrin, maltose, and glucose; but glucose is the end product. The action of diastase, however, whether it be vegetable (malt-diastase) or the animal diastase of the saliva (ptyalin), or of the pancreas (amylopsin), transforms starch into dextrin and maltose; no glucose is formed, maltose being the end product. It is especially to be noted that in the human digestion, not until food has passed the duodenum is any trace found of dextrose formed by the transformation of starch.

Czerny and Baginsky, among others, believe that starch is not acted upon by the saliva or by the pancreatic secretions, but that the *intestinal bacteria* produced the end products of decomposition resulting, not in sugar, but in butyric, lactic, succinic, and propionic acids. According to these authors intestinal bacteria cause the acid reaction and the abdominal distention.

THE ADDITION OF LIME-WATER, BICARBONATE OF SODIUM, OR OTHER ALKALIES TO COWS' MILK.

Lime-water is the alkali usually selected for neutralizing the acidity in cows' milk. It acts by partly neutralizing the acid of the gastric juice, so that the casein is coagulated gradually and passes, in great part, unchanged into the intestine, to be there digested by the alkaline secretions. As it contains only $^1/_2$ grain of lime to the fluidounce, the desired result cannot be attained unless at least a third part of the milk-mixture be lime-water. Instead of lime-water, 2 to 4 grains of bicarbonate of sodium may be added to each bottle, or, better still, from 5 to 15 drops of the saccharated solution of lime.

This solution is made in the following way:—

℞ Slaked lime	1 ounce
Refined sugar, in powder	2 ounces
Distilled water	1 pint

Mix the lime and sugar by trituration in a mortar. Transfer the mixture to a bottle containing the water, and, having closed this with a cork, shake it occasionally for a few hours. Finally separate the clear solution with a siphon and keep it in a stoppered bottle.

Bicarbonate of Soda Solution (Baking Soda).—Take 1 grain of soda bicarbonate to $^{1}/_{2}$ ounce of water. Or 1 drachm of soda bicarbonate to 1 quart of water. This is the proper strength used for diluting milk.

Quantity to be Used.—One tablespoonful of the last-named solution equals in strength 1 tablespoonful of ordinary lime-water.

Both lime-water and soda-bicarbonate solution should be kept in very clean, well-stoppered bottles and in a cool place.

The teaching that lime-water should be added to render cows' milk alkaline and thereby resemble human milk, has been studied by Kerley, Gieschen, and Meyers, whose conclusions are very interesting. They say that:—

1. Breast-milk and cows' milk are both acid.

2. The litmus paper test for milk is unreliable because of the variation in the quality of litmus paper, and the litmus taking part in the reaction and not acting as an indicator.

3. The effect of adding lime-water or bicarbonate of sodium to feeding is to retard or inhibit the formation of curds by rennet.

4. The teaching that lime-water, bicarbonate of sodium, or carbonate of potassium should be added to fresh milk or feedings simply because they are antacids is erroneous.

5. The addition to milk or feedings of alkalies or salts that become alkaline in solution is an empirical method of aiding digestion by preventing the formation of dense curds that would slowly leave the stomach and be difficult of digestion in the intestine.

In one respect I do not agree with them, and that is in regard to the addition of bicarbonate of potassium. In weak infants, especially in marasmic cases and in those infants in which "milk colic" appears one or two hours after being fed with cows' milk, I have found that by the *addition* of 10 to 15 grains of bicarbonate of potassium to each feeding improvement was invariably noted. I have not found this improvement when bicarbonate of soda or lime-water was added.

CREAM.

When food contains too little fat, or its equivalent (cream), we have fat-starvation, which is soon manifested by symptoms of rickets. One of the earliest symptoms of rickets is constipation, showing deficient muscular tone: a distinct atony of the bowel.

This can be remedied by the addition of fat or cream to the food. Some children are benefited by giving them codliver-oil, butter, or olive-oil, thus it is plain that each one desires to remedy the deficiency of fat in his own manner.

In buying cream from small milk-stores one can make a rough guess at the proportion of fat in cream by its thickness. A 50-per-cent. cream at the ordinary temperature of the room runs from a jug slowly and in a thick stream, almost like thick mucilage, whereas a 16 per cent. cream runs almost as freely as milk. This is, however, a crude way of estimating the difference between poor and rich cream. It is a very important point to know exactly what percentage of cream we are using, for such mixtures like Biedert's, in which 1 ounce of cream is mixed with 3 ounces of water, may agree very well when we use a 16 or 20 per cent. cream, but might be disastrous if we use a cream containing 40 per cent. of fat. Such infants would not tolerate this rich cream, and might have troublesome vomiting.

Cream for Home Modification.—*Ordinary Cream:* This is made by setting milk at night and skimming it in the morning; it is called gravity, or skimmed, cream, and contains 16 per cent. of fat.

Twelve Per Cent. Cream.—Obtained in the city by using equal parts of ordinary (20 per cent.) centrifugal cream and plain milk. In the country we must use 2 parts of ordinary skimmed, or gravity, cream (16 per cent.) with 1 part of plain milk, or by taking the top layer of milk, after it has stood five or six hours, by means of siphoning.

Eight per cent. cream is obtained in the city by diluting 1 part of centrifugal (20 per cent.) cream with 3 parts of plain milk; in the country, by using 1 part of gravity cream and 2 parts of plain milk, or by using the top layer of milk that has been standing five or six hours, siphoning it off.

How to Procure Cream.—Set aside the ordinary quart bottle of milk on the ice for several hours (from six to eight hours) to allow the cream to rise. After the cream has risen draw the milk from the bottom of the bottle; this can be accomplished by means of a siphon.

To make the siphon get a piece of glass tubing 21 inches in length and a quarter of an inch in caliber. This can be procured in any drug store. German glass is less liable to crack than American glass. If the glass tubing is longer than 21 inches make a small scratch in it, after measuring off 21 inches, with a three-cornered file, then grasp the glass tubing between the fingers and opposing thumbs of both hands, having the thumb-nails touching each other on the side of the glass just opposite to the scratch. On attempting to bend the glass tube it will break smoothly across, and if there are any sharp edges they can be smoothed by rubbing down with the file.

To bend the glass tube to the V shape, hold it in the flame of an ordinary gas jet or alcohol lamp for a few moments, twirling the glass rod until it softens sufficiently to allow it to be bent to the required angle. The tube should be warmed gradually at first, and then put right into the flame. It is better in bending the glass to make one arm of the siphon a few inches longer than the other.

In using the siphon hold it with the angle down, fill it with water, and close the long arm with the tip of the finger; then, keeping the finger applied to the long end, turn the siphon with the angle up, and introduce the short arm into the bottle of milk, letting it rest upon the bottom. On removing the finger, the milk will flow through the tube, and continue to do so until the bottle is empty. It is, therefore, necessary to watch the layer of cream, so that the siphon can be lifted out of the bottle just before the cream reaches it. There will thus remain in the milk-bottle all of the cream and a small portion of the milk, the latter depending upon the expertness of the person using the siphon.

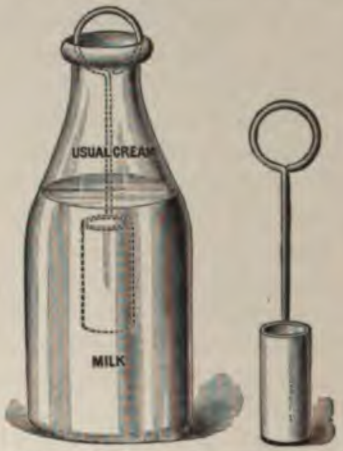


Fig. 41.—Chapin Cream Dipper.

A simpler method of obtaining the cream is by the use of a cream dipper (see Fig. 41). This can be purchased at any large drug store. The illustration explains itself.

To Pasteurize the Cream.—Take a clear glass bottle having a neck not very wide; fit into the same a perforated cork with a chemical thermometer registering up 212° F. The bulb of the thermometer should come within half an inch of the bottom of the bottle. The cream is put into the bottle, and the cork carrying the thermometer is inserted; the bottle is then placed in a pot containing a couple of inches of warm water and allowed to heat on the stove. The thermometer should be watched until it reaches 160, taking care that it does not go above 170. When the thermometer has reached this point, set the pot back on the stove where it will cool off, and allow it to remain there for twenty minutes. At the end of this time substitute a plug of absorbent cotton for the cork containing the thermometer. Great care must be taken to keep the absorbent cotton dry. Cream thus prepared is pasteurized, and will keep sweet and fresh for twenty-four hours without being kept on ice, and all that is necessary in removing a portion from the bottle is to be sure that the cotton plug does not become moist, or, if it should, to replace it with a dry piece at once.

To Clean the Glass Siphon.—It is advised to fill it with water immediately after using it, and the ordinary tube-brush having eighteen inches of wire added to it will permit thorough cleansing. Nothing, however, will be found as good as thorough boiling in plain water to which a pinch of soda has been added.

Modification of Milk.—It has been shown previously that the percentages of fat in woman's and in cows' milk are about the same, that the quantity of sugar is rather lower in cows' milk, and that the quantity of casein and albumin is greater in cows' milk, as is also that of the ash. Experience has shown that cows' milk must be diluted before it can safely be fed to infants. Simply diluting the milk reduces the percentages of fat and sugar too much; so that the practice of adding cream and sugar has arisen, but the processes that have been advocated for obtaining the desired additional quantities of fat and sugar have been too complicated for general use.

The top 9 ounces of a quart of milk on which the cream has risen will be about three times as rich in fat as the whole milk, the top 15 or 16 ounces will be about twice as rich as the whole milk, while the other ingredients remain about the same as in whole milk.

For babies under three months of age the top 9 ounces of a quart of milk on which the cream has risen should be diluted from three to ten times and 1 part of sugar added to 25 parts of food.

For babies three to six months old the top 16 ounces of a quart of milk on which the cream has risen should be diluted two or three times and 1 part of sugar added to 25 or 30 parts of food.

For babies six to nine months old the top 20 ounces of a quart of milk on which the cream has risen should be diluted one-half to one time and 1 part of sugar added to 50 parts of food. An even tablespoonful of granulated sugar equals half an ounce.

By following this method the infant commences on weak mixtures that show about the same composition and variations as woman's milk and gradually takes food richer in casein until plain milk is reached.

The diluents used are water, gruels, or dextrinized gruels, which are simply ordinary gruels the starch of which has been converted into soluble forms, leaving the cellulose and proteids of the cereal in a finely divided state. The effect of the different diluents will be mentioned farther on.

TABLE NO. 25.—*Feeding-table.*

(Geo. C. Carpenter, London).

Age.	Intervals of Feeding.	Number of Times in 24 Hours.	Average Amount Each Feeding.	Average in 24 Hours.
1st week	2 hours	10	1 oz.	10 oz.
1st month	2 hours	8	1½ to 2 oz.	12 to 16 oz.
2d month	2½ hours .	8	3 to 4 oz.	20 to 30 oz.
3d and 4th months . .	3 hours	7	4 to 5 oz.	30 to 35 oz.
5th and 6th months .	3 hours	6	6 to 7 oz.	34 to 40 oz.

Biedert's Cream Mixtures.[1]—The following formulæ are from the fourth edition of his book on "Infant-feeding," published in 1900:—

TABLE NO. 26.

	Formula.	Cream.	Water.	Milk-sugar.	Milk.	Casein. Per Cent.	Fat Per Cent.	Sugar Per Cent.
1st month .	I.	4 oz.	12 oz.	4½ dr.	. .	0 9	2.5	5
2d month .	II.	4 oz.	12 oz.	4½ dr.	2 oz.	1.2	2.6	5
3d month .	III.	4 oz.	12 oz.	4½ dr.	4 oz.	1.4	2.7	5
4th month .	IV.	4 oz.	12 oz.	4½ dr.	8 oz.	1.7	2.9	5
5th month .	V.	4 oz.	12 oz.	4½ dr.	12 oz.	2.0	3.0	5
6th month .	VI.	. .	8 oz.	3 dr.	24 oz.	2.5	2.7	5

According to recent milk analyses, it is necessary to take 6 per cent, which is equivalent to 5 $^{1}/_{2}$ drachms of sugar to 12 ounces of water. It has also been shown that cane sugar in the same quantity as milk sugar can be used. In using Formula 5, especially if an infant is constipated, it is advisable gradually to substitute milk for the water; thus we take away 1 ounce of water, and add 1 ounce of milk, until our formula is:—

Cream.	*Sugar-water.*	*Milk.*
4 ounces.	4 ounces.	20 ounces.

And gradually arrive at a whole milk feeding; in other words, give pure cows' milk undiluted. Biedert claims that frequently diluted cows' milk was not well borne, especially on weak stomachs, and the change to the cream mixture resulted in decided benefit. He believes that the cream mixture is assimilated far better than the diluted milk mixtures not containing cream. Thus he claims that the cases of constipation alternating with diarrhœa and lastly mucous enteritis are those in which the cream mixture will render satisfaction; but he advises that a definite rule must prevail regarding the amount of fat contained in the cream, and furthermore that an 8 to 10 per cent. cream be used.

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[1] Biedert's cream is sold in this country under the name of Ramogen.

Biedert's Directions for Making Cream. — From 1 to 2 quarts of milk are put into a broad jar (glass) on the ice, for no longer than two hours. He then removes with a flat spoon from 3 $^1/_2$ to 7 ounces of the thin white creamy layer over the bluish mass of milk. In removing the above quantity a small portion of the milk will be removed with it. *In cases of severe constipation Biedert insists on removing pure cream.*

The above Formula I is for the first month, Formula II is for the second month, Formula III is for a child from three to four months, Formula IV is for fourth to fifth month, Formula V is for the sixth to seventh month, and Formula VI is for the eighth to tenth month.

It is understood that, while feeding, the general condition of the child is the criterion, and thus we shall frequently be compelled to change the formula for individual requirements, some infants requiring far more cream than the above-mentioned formulæ give them for their age and their weight, whereas the great majority will require a modification of far less cream than the above-given formulæ for their age and weight.

The indiscriminate feeding of cream, to strengthen the baby, cannot be too strongly condemned. Many a dyspeptic owes his trouble to overfeeding by a too good mother or nurse. When cream is added, and the proportion of fat or proteid is too large, vomiting will result. Stuffing delicate children with cream, regardless of their digestive power, cannot be too strongly condemned. When improper food is given, and the infant's stomach is overtaxed, the excess of food irritates and may cause vomiting. If, however, the food remains, then the gastric mucosa is inflamed by bacterial fermentation of stagnant food. This may result in diarrhœa or in fermentative gastritis, and cause chronic enlargement of the stomach.

THE RIPENING OF CREAM.[1]

From the following table it will be seen that the number of bacteria in the unripened cream is very much more variable than that present in the ripened cream. In the unripened cream the number was sometimes as small as 1,000,000 per cubic centimeter, and in one case it was so small that it could not be determined with the high dilutions which were used. At the other extreme we have one sample of unripened cream collected in February with 220,000,000 bacteria per cubic centimeter. In the other experiments the figures range between these. The significance of this fact is, of course, simply that the cream as collected in the creamery, which we speak of as unripened, is really in different stages of ripening by the time it reaches the creamery. The samples with *large numbers* of bacteria are *already well ripened,* while those with *small numbers* have only begun their ripening process.

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[1] By Conn and Esten (Storrs Agricultural Experiment Station).

TABLE No. 27.—*Number of Bacteria in Unripened and Ripened Cream.*

Date.	Temperature During Time of Ripening.	In Unripened Cream.	In Ripened Cream.	Remarks.
		Per c. c.	Per c. c.	
October 28,	. . . .	125,000,000	350,000,000	
May 22,	64° for 20 hours	56,000,000	354,000,000	
May 26,	64–68° for 20 hours	60,000,000	320,000,000	Good aroma
May 29,	66° for 18 hours	186,000,000	295,000,000	Good aroma, gas
July 2,*	60–70° for 16 hours	214,000,000	380,000,000	Good aroma
July 5,*	63–65° for 16 hours	178,000,000	392,000,000	Good aroma, thick, slightly acid
July 12,*	71° for 17 hours	67,000,000	190,000 000	Good aroma, acid
July 16,*	71° for 16 hours	134,000,000	243,000,000	
July 19,	71° for 14 hours	75,000,000	286,000,000	Slow ripening
July 22,	. . . .	115,000,000	428,000,000	
October 13,	68° for 18 hours	72,000,000	291,000,000	
October 30,	60-65° for 28 hours	107,000,000	199,000,000	
November 3,	. .	39,000,000	234,000,000	
December 8,	60–70° for 29 hours	4,000,000	238,000,000	
December 11,	60–70° for 24 hours	35,000,000	200,000,000	
October 19,	60–70° for 24 hours	39,000,000	380,000,000	
October 26,	60° for 21 hours	115,000,000	297,000,000	Ripe when collected
November 2,	. . . .	158,000,000	355,000,000	

* Hot Weather.

The number of bacteria in the ripened cream varies far less. The smallest number found was 50,000,000; the largest number, 578,000,000. While this difference is of course in actual numbers a large one, the proportionate difference is very much less than in the unripened cream; one sample of unripened cream, for instance, containing two hundred and twenty times as many bacteria as another sample, while the largest number in the ripened cream was only about eleven times as great as the smallest number.

The only conclusions of any significance from these facts are that the cream received by creameries is in various stages of ripening, and secondly, that the number of bacteria in ripened cream does not run much over 500,000,000 per cubic centimeter. In the *well ripened cream this number is rarely surpassed.*

General summary of the conclusions which were drawn from the long series of experiments in regard to the actual bacteriological development that occurs during the normal ripening of cream:—

1. Milk as it is drawn from the cow contains great quantities of bacteria; most of these are miscellaneous forms of liquefying bacteria and other non-acid species. At the outset the number of acid bacteria is very small.

2. All species of bacteria increase during the setting of the milk for the separation of the cream.

3. For a few hours the alkaline bacteria and the others which have been included under the head of miscellaneous forms increase quite rapidly, while the lactic bacteria are hardly evident.

4. After about twelve hours the lactic bacteria have increased so much as to be as numerous as the others, and from this time on they continue to increase with great rapidity until a maximum is reached at about forty-eight hours; after this the numbers gradually decrease and they finally practically disappear.

5. The ripened cream contains prodigious numbers of bacteria, larger numbers than are known in any other natural medium. They are, however, nearly all lactic bacteria.

6. After the first twelve hours all species of bacteria except the two lactic species decrease in relative numbers and finally absolutely disappear.

7. The cream which is received by a creamery is already partly ripened, as indicated by the immense numbers of bacteria it contains. All of the changes which occur in the cream under the influence of the miscellaneous bacteria have already occurred, and the ripening that takes place in the creamery is due wholly, or almost wholly, to the growth of the acid bacteria.

8. A ripened cream is almost a pure culture of acid bacteria, but this does not mean that the ripening has been produced by these acid bacteria alone.

9. That the lactic bacteria play an important part in the ripening is perfectly evident; that they are the sole cause of the changes occurring in the ripening is not so evident.

10. The peculiar flavor of June butter, which is so much desired by the butter maker, is not due to the development of the common lactic bacteria. Butter ripened during the winter months develops the two species of lactic bacteria as abundantly and as quickly as does that ripened in June, but the flavor does not make its appearance. In the last three experiments recorded the June flavor was very noticeable in the cream, but the development of the acid bacteria, or the two species referred to, was practically the same as in all of the previous experiments. The June flavor, therefore, cannot be due to these common lactic bacteria.

11. To what this June flavor is due we are not as yet satisfied. Whether it will prove to be due to the large growth of miscellaneous bacteria during the first few hours of ripening, or whether it is due to a difference in the chemical nature of the cream, remains for further experiments to decide.

TOP MILK.

Top-milk is obtained directly from fresh milk by the so-called "gravity process." Cream contains a great deal of fat, usually three-fifths of cream is fat; this floats on the surface of the watery milk. If a quart bottle of the average city milk is put into ice-water or upon ice in the refrigerator, and removed after four or five hours, we can skim off from the top about 10 ounces of an 8 per cent. cream; after six hours about 6 ounces of 12 per cent. cream. This I shall speak of as top-milk. Frequently, instead of skimming the cream, the lower portion is siphoned off, leaving the cream in the glass bottle. When cream is removed by a centrifugal machine, it is known as centrifugal cream. It can be separated much more quickly than so-called gravity cream, which must rise naturally and slowly from milk that is allowed to stand.

My experience with top-milk feeding has been bad. Infants fed on top-milk diluted with water have gradually shown dyspeptic symptoms, and it was necessary to give the stomach absolute rest by using very dilute solutions of milk and rice or barley water. An interesting case of top-milk feeding came to my office recently:—

Child three months old having stools containing curds and greenish mucus. All gastric disturbances were present. Vomiting followed each feeding. When the top-milk was stopped the gastric symptoms subsided.

My rule has been to give bottle-fed infants first, *a very minute* quantity of milk, 1 part of milk with 3 or 4 parts of water. If the same is assimilated, I increase the quantity of milk and decrease the water from week to week. Top-milk or cream feeding should be used cautiously. I believe that more cases of dyspepsia are caused by this heavy form of feeding than by any other method of feeding.

CHAPTER III.

HOME MODIFICATION OF MILK.

BOTTLE-FEEDING OR HAND-FEEDING.

THE following utensils are required for the home modification of milk:—

Two-quart pitcher, }
Funnel, } glass or porcelain.
One large spoon, }
One dozen 4-ounce bottles (later substitute 8-ounce bottles).
One dozen anti-colic nipples.
One box non-absorbent cotton.
One saucepan (for heating milk).
One high saucepan (for warming bottle before feeding).

GENERAL RULES FOR BOTTLE-FEEDING.

No set rule can be given for all infants. Each infant's desires must be studied. The stomach capacity of one infant may be 6 ounces at the age of two months, while another equally healthy infant will be satisfied with 4 ounces at one feeding.

TABLE NO. 28.

Age of Child.	Frequency or Interval of Feeding.	Number of Feedings in 24 Hours.	Average Amount for Each Feeding.	Average Amount in 24 Hours.
From birth to 1 month	2 hours	10	1 to 2 ounces	10 to 20 ounces
1 to 2 months	2½ hours	8	3 to 4 ounces	24 to 32 ounces
2 to 4 months	3 hours	6 or 7	3½ to 5 ounces	24 to 35 ounces
4 to 6 months	3 hours	6	5 to 7 ounces	30 to 42 ounces
6 to 9 months	3½ to 4 hours	5	8 ounces	40 ounces
9 to 12 months	4 hours	4	8 ounces	32 ounces
1 year	4 hours	4	8 ounces	32 ounces[1]

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[1] See article on "Additional Foods During the Nursing Period," in Chapter on "Breast-feeding."

These individual peculiarities must be taken into consideration when estimating the quantity of food for each meal. An infant that cries after taking its bottle, and puts its fingers to its mouth and whines and frets, if otherwise normal, is generally underfed. When children are underfed they usually have greenish, spinach-like stools.

Formula No. 1 (for a child from birth to one month old):—

℞ Raw cows' milk	4 ounces
Rice water[1]	16 ounces
Granulated sugar	1 ounce

Mix thoroughly. Heat in a new saucepan until steam rises. Continue steaming at same temperature ten minutes. Divide into ten bottles (2 ounces each). Insert in the necks of the bottles large cotton stoppers. Place the bottles in a refrigerator, but not on ice. Warm before feeding, by placing bottle into a deep saucepan of hot water until the food reaches the body temperature.

Formula No. 2 (for a child from one to two months old):—

℞ Raw cows' milk	7 ounces
Rice water	20 ounces
Granulated sugar	$1\,^1/_2$ ounces

Divided into eight bottles, each bottle containing about 3 ounces. Feed every two and one-half hours.

Formula No. 3 (for a child from two to four months old):—

℞ Raw cows' milk	12 ounces
Rice water	23 ounces
Granulated sugar	$1\,^1/_2$ ounces

Divide into seven bottles, each bottle containing about 5 ounces. Feed every three hours.

Formula No. 4 (for a child from four to six months old):—

℞ Raw cows' milk	22 ounces
Rice water	20 ounces
Granulated sugar	1 ounce

Divide into six bottles, each bottle containing about $5\,^1/_2$ ounces. Feed every three hours.

Formula No. 5 (for a child from six to nine months old):—

℞ Raw cows' milk	28 ounces
Rice water	12 ounces
Granulated sugar	$1\,^1/_2$ ounces

Divide into five bottles, each bottle containing about 8 ounces. Feed every three and one-half hours.

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[1] For formula of rice water, barley water, and other diluents, see "Dietary."

Formula No. 6 (for a child from nine to twelve months old) :—

℞ Raw cows' milk	27 ounces
Rice water	5 ounces
Granulated sugar	1 $^{2}/_{3}$ ounces

Divide into four bottles, each bottle containing 8 ounces. Feed every four hours.

Formula No. 7 (for a child over 1 year of age) :—

℞ Raw cows' milk	32 ounces
Granulated sugar	1 $^{2}/_{3}$ ounces

Divided into four bottles, each bottle containing 8 ounces. Feed every four hours.[1]

The modification of cows' milk with the addition of Eskay's albuminized food has served me very well. The food has a decided mechanical effect on the casein, splitting it up, thus rendering it more flocculent. To children over five months I usually give the following:—

℞ Raw cows' milk	5 ounces
Rice water	3 ounces
Eskay's albuminized food	1 teaspoonful
Granulated sugar	1 teaspoonful

Mix the ingredients thoroughly and heat in a saucepan until the steam rises. It is important to use none but fresh milk, and milk that contains at least 4 per cent. of fat. If less fat exists in the milk a tendency to constipation may arise.

The addition of a teaspoonful of *calcined magnesia* or a teaspoonful of the fluid *milk of magnesia,* sold in drug stores, given with the morning bottle, will correct constipation. From month to month as the child increases in weight and assimilates the food, we can add more of the Eskay's food, more cows' milk, and reduce the rice water.

The following formulæ have proven very successful and are copied from my book on "Infant-Feeding in Health and Disease"[2] (Chapter XXI, p. 152) :—

OTHER RULES FOR BOTTLE-FEEDING.

For a Child at Birth. Formula 1.—The new-born infant's food should consist of (home modification) :—

FORMULA FOR HOME USE.

Fat	1.0	Cream	2 ounces
Sugar	5.0	Milk	2 ounces
Proteids	0.75	Lime-water	1 ounce
Reaction alkaline.		Water	15 ounces
		Milk-sugar	6 $^{3}/_{4}$ drachms

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[1] See article on "Additional Foods During the Nursing Period," in the chapter on "Breast-milk."

[2] Louis Fischer: "Infant Feeding in Health and Disease," Third Edition, F. A. Davis Company.

The above formula (1) is to be divided into 10 feedings of 2 ounces each, or 60 cubic centimeters each, and should be heated for twenty minutes to 167° F., though Russell, of Wisconsin, has proved by experiment that tubercle bacilli are destroyed at 140° F., which temperature may answer when a good source of milk is found.

The cream must contain at least 10 per cent. of fat. This is known as a decimal cream, and can be referred to under the heading of "Cream for Home Modification."

Child 1 Month. Formula 2.—Take of:—

Fat	2.0	Cream	4 ounces
Sugar	5.0	Lime-water	1 ounce
Proteids	0.75	Water	15-25 ounces
Lime-water	5.0	Milk sugar	6 3/4 drachms

The above quantity is to be divided into ten feedings, and heated for twenty minutes to 167° F., and the infant to be fed once every two hours. In Formula 2 we have added more cream and purposely left out the milk. If the infant thrives on this mixture, then we can substitute 1 ounce of milk instead of 1 ounce of water. Some children will not be satisfied with less than 3 to 4 ounces; there is no reason why they should not receive the above quantity if their general condition warrants it.

After the end of the second month the quantity of food can be increased if the infant's appetite, sleep, stools, and general condition warrant it. Thus, instead of feeding a bottle of Formula 2, we simply add 1 ounce of milk for the third month to Formula 2. Frequently the addition of 1 or 2 ounces of sterile water to the formula will give a larger bulk and satisfy the infant. As every infant's appetite and gastric capacity is different, we must carefully note the condition of the baby after its feeding before resorting to fixed rules.

At Four Months. Formula 3.—Take of:—

Fat	3.5	Cream	7 ounces
Sugar	6.5	Milk	1 ounce
Proteids	1.5	Lime-water	1 ounce
Lime-water	5.0	Water	25-32 ounces
		Milk-sugar	6 1/4 drachms

Divide into eight bottles; heat as above to 167° F.; feed every three hours.

From Nine to Twelve Months. Formula 4.—Take of:—

Fat	4.0	Cream	8 ounces
Sugar	7.0	Milk	7 1/2 ounces
Proteids	3.0	Lime-water	1 ounce
Lime-water	5.0	Water	20-30 ounces
		Milk-sugar	6 3/4 drachms

The above to be divided into five feedings, heated to 167° F., and one bottle fed every four hours.

Clinical Illustrations of How to Feed (from the Author's Private Records).

Case I.—Baby V., was referred to me for treatment April 3, 1901.

The child was three and a half months old at time of commencing treatment, and weighed 8 pounds and 10 ounces.

History: Breast-fed about two weeks; since then fed on milk diluted with water and milk-sugar; food was steamed forty minutes. Child had always been constipated, always cries, and suffers with colic.

Gave barley and condensed milk with lime-water; child seemed to do well; weight was about 10 pounds. After several weeks cream was added to the food. After this addition of cream the child vomited and cried, had severe *colic*, was restless by day, and had insomnia at night. Its bowels were so disturbed that all milk was stopped. Barley-water was the only food tolerated. Then cereal milk was prescribed. The cereal milk was not retained; child vomited after each feeding, then was constipated, which alternated with greenish, dark stools. Infant was emaciated; the stools contained mucus.

Physical Examination: Very emaciated child; temperature, 100° F.; abdomen distended, very flatulent; skin dry, elasticity lost; herpetic eruption on lips and around anus; pulse, 140 and feeble; throat clean; lungs normal; heart-sounds, very feeble; left inguinal hernia.

Diagnosis: Athrepsia, resulting from chronic gastric catarrh.

Food ordered:—

Pure cows' milk	2 ounces
Oatmeal-water	2 ounces
Granulated sugar	$^1/_2$ teaspoonful
Peptogenic powder	$^1/_2$ teaspoonful

Feed every three hours. Alternate with:—

Pure cows' milk	2 ounces
Barley-water	2 ounces
Granulated sugar	$^1/_2$ teaspoonful
Peptogenic powder	$^1/_2$ teaspoonful

Heat this mixture slowly for ten minutes, then boil one minute.

Mother reports that the child takes food well, stools are yellow, and child passed a good night, but still has eructations and seems colicky. The food was continued, and the child gained *ten ounces* in seven days.

Weight, April 3	8 pounds and 10 ounces
Weight, April 10	9 pounds and 4 ounces
Weight, April 17	9 pounds and 8 ounces
Weight, April 24	9 pounds and 14 ounces
Weight, May 1	10 pounds and 4 ounces
Weight, June 3	12 pounds and 5 ounces
Weight, June 15	13 pounds and 12 ounces
Weight, Dec. 20	19 pounds

Extract of malt was ordered, $^1/_2$ teaspoonful three times a day. Every week the formula was changed, commencing with:—

Milk	2 ounces	Formula I
Barley-water or oatmeal-water	2 ounces	

One week later I ordered:—

Milk	2 1/2 ounces	Formula II
Barley-water or oatmeal-water	2 1/2 ounces	

Feed every three hours.

Raw milk	3 ounces	Formula III
Barley-water or oatmeal-water	3 ounces	
Peptogenic powder	2 teaspoonfuls	
Granulated sugar	1/2 teaspoonful	

Feed every three or three and one half hours.

I ordered this infant to be awakened by day for feeding, but not to be disturbed at night. When the child cried after feeding when 5 months old, instead of giving Formula III, I ordered:—

Raw milk	4 1/2 ounces	Formula IV
Barley-water	2 1/2 ounces	
Peptogenic powder	1/2 measure	
Granulated sugar	1/2 teaspoonful	

The above for one feeding. Feed every three or three and one-half hours. Substitute oatmeal-water for barley-water every other day.

Milk	5 1/2 ounces	Formula V
Barley-water	2 ounces	
Peptogenic powder	1/2 measure	
Granulated sugar	1/2 teaspoonful	

Alternate with oatmeal-water. Feed every three and one-half or four hours.

Case II.—Dorothy L. F., *eleven months old*, was referred to me for treatment on March 18, 1901, by Dr. H. J.

The history elicited was: The baby is *still nursing* and appears undersized, very anæmic, and poorly developed. No evidence of teething; cannot walk nor talk. Has had summer complaint. Recently suffered with constipation. Had diarrhœal stools some time ago; stools were greenish in color, and contained curds and mucus. Has had a cough lasting three weeks; also sniffles. A restless sleeper, rarely sleeping more than one-half hour at a time during the day. Is frequently very raw between thighs and on buttocks. Child is very flatulent.

Physical Examination: A very frail child; large abdomen; slight evidence of rickets; very feeble heart-action; lungs normal; spleen palpable; liver very much enlarged; colon distended, tympanitic on percussion; muscles of extremities very flabby; bones very small; epiphyses of long bones very much enlarged; tongue coated; throat normal; some adenoids.

Specimen of breast-milk sent to chemist for examination showed·—

Quantity, about 2 ounces, or 60 cubic centimeters.
Reaction slightly alkaline.

Specific gravity	1.03105
Fat	1.22
Sugar	7.07
Proteids	0.98

Shows low fat and low proteids.

The baby weighed about 4 1/2 pounds at birth, and weighed between 12 and 13 pounds when 6 months old. It now weighs naked about 16 pounds.

From the history I learned that the mother menstruated while nursing since her child was 4 months old. The infant's restlessness was evidently associated with this condition.

The study of the chemical examination of the breast-milk which this child received easily explains the poor development, the proteids being less than 1 per cent., besides a very low percentage of fat being also partly responsible.

Treatment: Absolute weaning from the mother's breast.

Pure cows' milk, warmed to feeding temperature, or about 100° F., 6 ounces to be given at each feeding. Feed every four hours; strict observance of interval of feeding and careful attention to sterility of everything coming in contact with food or utensils to be used.

Medication: One-half teaspoonful of malt-extract given three times a day.

This food was not well assimilated, so I ordered ½ measure of peptogenic milk-powder to be added to each 6 ounces of raw milk. Gradually heat in a saucepan over a small flame for five minutes, then heat more rapidly and boil for about ten seconds. Repeat every four hours. Prepare each bottle separately. Do not warm the food a second time, if the bottle is not emptied at one feeding.

My record three days later shows: Had a very good night. Better appetite, formerly took only 3 to 4 ounces, now takes almost 5 ounces. Did not moan last night.

March 27th: Child looks better; bowels moved twice naturally, and have a yellowish color, but no curds. Temperature, 99° F.; pulse, 120; respiration, 36.

This feeding was continued for about three weeks, and owing to good results, no changes were made.

This is the mother's report, which I copy:—

"April 8th: Had a good night; slept from 10.30 P.M. to 6.30 A.M. continuously. Bowels are splendid, yellow; three stools yesterday. Has a slight irritation of genitals; seems to be fumbling with the parts." Examination showed vulvitis, irritation due to scratching, slight eczematous intertrigo.

Diet ordered: To continue raw milk modified with peptogenic powder; in addition thereto beef-soup thickened with either hominy, sago, or farina. Feed two hours after milk-bottle once a day, preferably about noon. Give the child the white of a raw egg with sweetened water every other day. The child received soup, alternating the next day with the white of egg, in the following manner:—

Warm raw milk, modified with peptogenic	6 ounces	at 6 A.M.
Milk, peptogenic	6 ounces	at 10 A.M.
Soup, thickened	6 ounces	at 12 Noon
Milk, peptogenic	6 ounces	at 2 P.M.
Milk, peptogenic	6 ounces	at 6 P.M.

This food was well borne; the child gained. To improve the appetite 1 minim of nux vomica was ordered three times a day, before three feedings.

Warm or *raw milk,* modified by heating with peptogenic as directed above:—

Raw milk, 6 ounces	6 A.M.
Raw milk, 6 ounces	10 A.M.
White of raw egg, sweetened	12 Noon
Milk with peptogenic	2 P.M.
Milk with peptogenic	6 P.M.

Malt extract was discontinued every other week and an emulsion of codliver-oil ordered; 25 per cent. of oil was given. Each teaspoonful of the emulsion contained 2 grains each of glycerophosphate of lime and glycerophosphate of soda.

May 14th: We discontinued giving peptogenic and simply gave the baby raw milk warmed immediately before feeding. The milk was thickened by giving zwieback and bread-crumbs. I also ordered steak-juice, fed several teaspoonfuls at noon with some bread-crumbs or cracker-dust, and roast-beef juice. Also ordered egg-crackers, bread and butter, and soup made with mashed peas in which meat was boiled.

June 1st: Somatose $^1/_2$ teaspoonful to be stirred with milk or soup; repeat the dose three times a day. Also ordered raw apple-pulp sweetened with sugar.

June 20th: Discontinued raw white of egg, and gave half of soft-boiled egg, half of yolk and half of white, followed by bottle of milk at 10 A.M.

Child now weighs 19 $^1/_2$ pounds.

Treatment discontinued; child went to the sea-shore. I did not see the child until middle of September, three months later. Has had summer complaint; food changed; different milk used in country evidently the cause. Child now weighs 18 $^1/_2$ pounds. This child received pea-soup, cocoa, zwieback, and Nestlé's food. I ordered:—

Farina boiled in milk.
Rice boiled in milk.
Use one-half milk and one-half water.
Boil one hour or longer.

Also some barley-soup, afternoon cocoa, or milk, in the following manner:—

Feed at 6 A.M.	Milk	4 ounces
	Water	4 ounces
	Granulated sugar	1 teaspoonful
	Lime-water	1 teaspoonful

Feed at 10 A.M., same as above, also farina or rice boiled in milk.

Feed at 12 noon, soup made from chicken or beef thickened with barley.

Feed at 2.30 P.M.	Milk	6 ounces
	Chocolate or	
	Cocoa	2 teaspoonfuls
	Granulated sugar	2 teaspoonfuls
	Water	2 ounces

Avoid all lumps in chocolate by rubbing up with hot water and gradually adding the milk. Heat over small flame and stir well.

Feed at 6.30 P.M., milk thickened with egg-cracker or zwieback.

This food was well assimilated, and then the following was added: Sliced apple in the morning; pudding made from broken zwieback, some milk, and yolk of egg.

September 30th: Shredded wheat, oatmeal, or farina with milk, was allowed in addition to the afternoon cocoa or chocolate feeding above ordered. At noon chicken bouillon or soup, to which yolk of raw egg, well beaten, was allowed.

In October we gave raw scraped steak on a soda-biscuit. Also ordered fresh vegetables, stewed or mashed peas, some spinach and cauliflower, and baked potato with butter.

Bone-marrow, 1 teaspoonful three times a day, was ordered.

The child made excellent progress. Teeth appeared, and the child is strong, well, and able to walk; no physical defect is visible; mentally the child is normal, and, indeed, to all appearances it is now a normal child.

Case III.—Dyspeptic Infant, Requiring Careful Bottle-feeding, now Perfectly Well. Baby Douglas C. M., child of a physician, was born May 29, 1901. Weighed at birth 9 pounds. Was breast-fed about two months. Owing to swollen breasts, the milk suddenly ceased. The child was weaned. Weight, 12 pounds. Stools normal at time of weaning. Hand-feeding with equal parts of milk and water was tried. As this was not well borne, Mellin's food was given.

When first seen by me the infant had frequent attacks of vomiting; greenish stools, containing curds and mucus. Cries with colicky pains. Has constant intestinal fermentation.

Infant at 4 months, while suffering with colic, was given:–

Pure milk	14 ounces	Formula I
Barley-water[1]	20 ounces	
Granulated sugar	4 teaspoonfuls	
Lime-water	7 teaspoonfuls	

Mix the above and divide into seven clean bottles. Place in a refrigerator until required. At feeding-time empty contents of a bottle into a saucepan and allow the food to come to a boil, then immediately remove from heat. When cooled to feeding temperature, give it to the baby. Usual temperature is about 100° F., or blood-heat.

In addition to the above food prune-water, made in the following manner, was ordered for thirst:—

Fleshy prunes	1 dozen
Granulated sugar	3 teaspoonfuls
Water	2 teacupfuls

Mix together and boil for thirty minutes. Strain; feed when cold. Three to 6 teaspoonfuls can be given at one time.

Fresh orange-juice, 3 teaspoonfuls one hour before milk-feeding, once a day.

When seen a few days later it was found that the child had had, during the day, five greenish-yellow stools, containing cheesy curds.

Ordered oleum ricini, 1 teaspoonful at 10 A.M.

Feed at	11.30 A.M.
Feed at	2.30 P.M.
Feed at	5.30 P.M.
Feed at	8.30 P.M.

If looseness continues, leave out sugar and substitute saccharin, $^1/_2$ grain to each bottle.

Following day ordered:—

Milk	20 ounces	Formula II
Barley-water	14 ounces	
Sugar	4 teaspoonfuls	
Lime-water	7 teaspoonfuls	

Mix the above and divide into seven bottles. Scald each bottle before feeding.

---

[1] Barley-water is made by adding a tablespoonful of prepared barley to a pint of water, boiling for five minutes, straining through cheese-cloth, and again adding enough water to make a pint.

Infant cried and still seemed hungry after feeding, and the food was increased:—

Whole milk	14 ounces	Formula III
Gravity cream	7 ounces	
Sterile water	20 ounces	
Cane sugar	5 teaspoonfuls	

Mix the raw milk and cream in a clean bottle and add the water and sugar. Divide into seven bottles and keep in a refrigerator until feeding-time. Keep bottles well stoppered with absorbent cotton. Warm the bottles in hot water at feeding-time. Feed every three hours.

The following day the child had no stool from 2 A.M. to 10 A.M. It seems better satisfied after the bottle, and takes food greedily.

Food changed to:—

Whole milk	20 ounces	Formula IV
Barley-water	14 ounces	
Sugar	4 ounces	
Lime-water	7 teaspoonfuls	

Divide into seven feedings. Feed every three hours.

As the above formula agreed, I ordered:—

Whole milk	21 ounces	Formula V
Barley-water	14 ounces	
Sugar	4 teaspoonfuls	

Scald the milk and divide into seven feedings. Feed every two and three-fourths or three hours.

Gained one pound during the week; has yellowish stools after each feeding; no vomiting; cries after feeding; appears dissatisfied.

Changed feeding to:—

Whole milk	30 ounces	Formula VI
Barley-water	12 ounces	
Saccharin	3½ grains	

Divide into seven feedings. Scald the raw milk with hot barley-water; then put in ice-chest until feeding-time. Boil two minutes in saucepan before feeding.

Stool after each feeding, yellow, normal consistency, alkaline reaction. Child does not sleep well; seems hungry. Food changed to:—

Whole milk	36 ounces	Formula VII
Barley-jelly[1]	12 ounces	
Saccharin	3½ grains	

Add 1 teaspoonful of cream to each feeding; discontinue if vomiting or if cheesy curds appear in stools. Scald milk as before. Feed every three hours.

Child still appears hungry after feeding. Stools less frequent. No vomiting. Has small, rose-colored spots on legs and face. Weight, 13 pounds.

---

[1] To make barley-jelly take 2 heaping tablespoonfuls of barley to 12 ounces of water, boil down, and again add enough water to make 12 ounces.

Feeding changed to:—

Milk	42 ounces	Formula VIII
Cream	2 ounces	

Divide into seven bottles and feed every three hours.

If food does not agree add 1 teaspoonful of Fairchild's peptogenic milk-powder to each bottle and heat for three minutes before feeding.

Ordered two doses of calomel; $^1/_{10}$ grain given.

Child appears very bright. Has yellowish stools, no colic; abdomen not distended. No evidence of vomiting. Sleeps well all night.

Feeding changed to:—

Milk	48 ounces	Formula IX
Cream	4 ounces	
Dextrinized wheat	7 teaspoonfuls	

Sweeten and heat as before. Divide into seven bottles.

To make dextrinized wheat take 3 pounds of plain wheat-flour, boil in a bag for five hours, then dry in the oven, break open, reject the rind, and grate into powder.

Child did not digest the dextrinized-wheat feeding. Changed to pure milk. Child now takes pure milk, 5 to 6 ounces.

To relieve eczematous excoriation on buttocks, ordered:—

℞ Calamin	3.0
Zinc oxide alb	3.0
Lanolin or cold cream	30.0

Apply t. i. d.

Child does not sleep well at night. Ordered milk steamed in double boiler for twenty-five minutes. Child cried very much during the last few days; had thin, yellowish stools after each bottle.

To relieve thin, watery stools ordered:—

℞ Acid. HCl dilut	2.0
Essence of pepsin	60.0

Sig.: Teaspoonful three times a day before feeding.

Owing to an eczema on the buttocks after applying the salve, ordered equal parts of pulverized zinc oxide and talcum dusted over salve on buttocks.

For the loose bowels the rectum and colon irrigated with $^1/_2$ pint of chamomile-tea, to which was added 10 grains of tannic acid. Temperature of irrigation, about 105° F.

Oleum ricini, 1 teaspoonful, internally.

Changed feeding to:—

Milk	4 ounces	Formula X
Barley-water	1 $^1/_2$ ounces	
Arrowroot	1 heaped teaspoonful	

Boil, and feed every three or three and one-half hours, alternating with thickened rice-soup or rice-water, 4 to 6 ounces at one feeding. Baby did very well on this diet, assimilated the food, and gained in weight. Had one or two yellowish, well digested stools daily. After this improvement I ordered soups and white of egg.

The child weighed, at six months, 18 pounds. The child is perfectly well, walks and talks, and is now in his second year, with normal dentition.

Materna Home Modifier.—This is a glass apparatus for the modification of cows' milk at home, and consists of a glass vessel with pouring-lip, shaped like a graduate, holding 16 ounces. The outer surface is divided by vertical lines into seven panels; one panel shows the ordinary ounce graduation; the six others show six different formulæ, so arranged as to be suitable for the entire first year's feeding. The accompanying diagram is a more or less accurate reproduction of the arrangement of these panels.

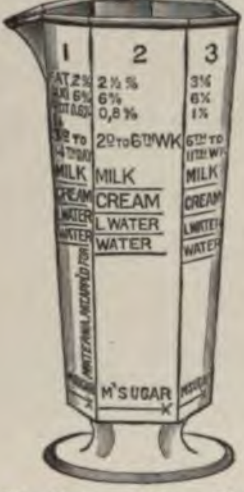

Fig. 42.—Materna Home Modifier.

It is possible to obtain other percentages than those shown on the panels, by mixing what is called for by two adjacent formulæ; as, for instance, equal quantities made according to Formulæ 1 and 2 combined will give: fat, 2 ¹/₄ per cent.; proteids, 0.7 per cent.; sugar, 6 per cent.

As may readily be seen, all the formulæ call for the same ingredients, excepting the sixth, which, instead of water, requires barley gruel, and granulated sugar in place of milk sugar.

The method of using the apparatus is extremely simple. Having decided upon the formula to be used, that panel is to be observed to the exclusion of all the others. The respective ingredients are then poured into the vessel, to the line below the designated substance. Thus, milk sugar is put in first (or, in its absence, granulated; and the line with the cross shows to what point the latter should be used), then the water, lime-water, cream, and milk in the order shown. The whole is then stirred, and the result will be a milk whose formula is at the top of the panel. The milk used with the apparatus should be good average milk. The cream should be the light centrifugal cream as obtained in bottled milk (16-20 per cent.). The water should be hot, to dissolve the sugar. The barley gruel should be prepared in the usual way with Robinson's or ordinary barley.

According to the age and size of the child, the vessel must be filled once, twice, or three times to obtain the quantity requisite for the twenty-four hours' feeding. The pouring into bottles and sterilization are then done as usual. Full directions, including a schedule for the twenty-four hours' feeding at the various periods of the child's growth, accompany the apparatus, which is simple, accurate, and economical, making properly modified milk of practical value obtainable in places where it has hitherto been impossible to get it.

1. 3d-14th Day. Fat 2%. Proteids, 0.6%. Sugar, 6%.	2. 2d-6th Week. Fat, 2½%. Proteids, 0.8%. Sugar, 6%.	3. 6-11th Week. Fat, 3%. Proteids, 1%. Sugar, 6%.	4. 11 wk.-5 mo. Fat, 3½%. Proteids, 1½%. Sugar, 7%.	5. 5th-9th month. Fat, 4%. Proteids, 2%. Sugar, 7%.	6. 9th-12th month. Fat, 3½%. Proteids, 2½% Sugar, 3½%.
Milk	Milk	Milk	Milk	Milk	Milk
Cream	Cream	Cream	Cream	Cream	Cream
Lime-water	Lime-water	Lime-water	Lime-water	Lime-water	Barley-gruel
Water	Water	Water	Water	Water	Gr. sugar
Milk-sugar	Milk-sugar	Milk-sugar	Milk-sugar	Milk-sugar	
x	x	x	x	x	

The materna is adapted for home use only when the physician notes results. To intrust an apparatus of this kind into the hands of a mother or nurse not conversant with the difference in the percentage of fat contained in cream is not only wrong, but will prove disastrous to the infant so fed before many weeks are over. The author recently saw a case of dyspepsia brought about by feeding in this careless manner. On the other hand, the apparatus will serve as a guide to those physicians whose training in percentage-feeding requires occasional assistance.

A very practical "milk modifying gauge" devised by Mitchell has been placed on the market. It can be procured from the National Drug Company of Philadelphia. It is designed to aid those unfamiliar with home modification, and is especially valuable to those distant from large cities with laboratories.

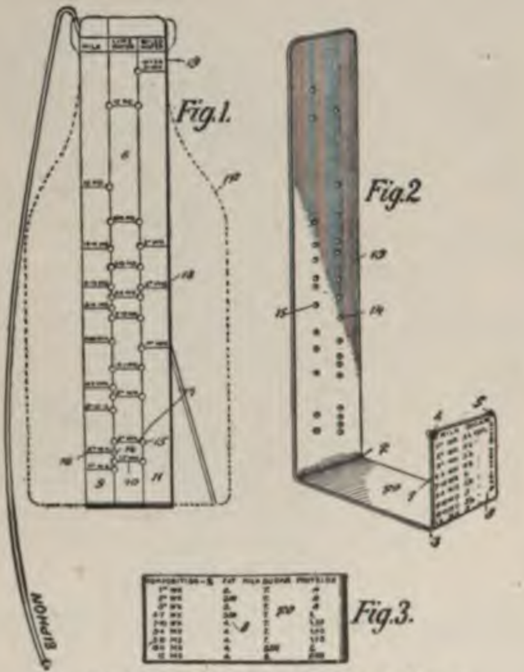

Fig. 43.—Mitchell's Milk Modifying Gauge.

TABLE No. 29.

DIET FOR A CHILD FROM ONE YEAR TO FIFTEEN MONTHS.[1]

5	A.M.	Orange juice, Apple sauce, or Prune jelly.
6	A.M.	Milk, 8 ounces, with zwieback or crackers.
10	A.M.	Milk, 8 ounces.
12.30	P.M.	Beef or chicken soup, thickened with toast crumbs, or
12.30	P.M.	Expressed steak juice or beef blood, with toast crumbs.
3	P.M.	Milk, 8 ounces, with soda biscuit.
5	P.M.	Apple sauce.
6.30	P.M.	Milk, 8 ounces.

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[1] In the chapter on "Weaning," I have already described in detail another method of substitute feeding for a child about 1 year old.

TABLE NO. 30.

DIET FOR A CHILD FROM EIGHTEEN MONTHS TO THREE YEARS.

6.30 A.M.	Orange juice. Apple sauce, or Prune jelly.
7.30 A.M.	Warm milk, 8 ounces; Mellin's Food, 1 teaspoon, or Eskay's Food, 1 teaspoon; Zwieback or cracker, with butter.
11 A.M.	Farina, Hominy, Cream of wheat, Oatmeal, or Grape-nut, scalded with hot milk; in addition, a cup of Warm milk, 6 ounces.
2 P.M.	A soup, a meat, a vegetable, and a cracker. Beef or chicken soup, thickened with split peas, sago, rice, or farina. Drink of water.
2 P.M.	Clear broth, with yolk of egg, or one or more ounces of expressed beef blood. Oyster or clam broth. Joint of chicken, Broiled halibut, Raw scraped steak, Chicken jelly, or Calf's-foot jelly (without wine flavor). Baked potato, with butter; Spinach, or Carrots.
6 P.M.	Crust of bread or zwieback. Warm milk, with white of egg; or Cocoa. Junket, custard, corn starch, tapioca, or farina pudding, a few teaspoonfuls.

DIET FOR A CHILD FROM THREE TO TEN YEARS.

A child of 3 years, excepting in rare instances, should not be fed oftener than three times a day. The best time for feeding is: morning meal, 7 to 8 A.M.; noon meal, 12 to 1 P.M., and evening meal, 5.30 to 6.30 P.M.

In rare instances fruit or a cup of milk may be allowed between the noon and evening meal.[1] In the majority of cases five hours are required to fully digest the food given.

The morning meal should consist of a fruit, a small dish of cereal with cream, a cup of milk, and a piece of toast or crackers.

The noon meal should consist of a plate of soup, a small portion of meat, a small potato, a vegetable, bread, or crackers, or stale sponge cake, water.

The evening meal should consist of an egg or pudding, a cup of cocoa or milk, crackers or bread with butter or honey.

It is safer to give a light meal in the evening rather than load the stomach with heavy food. The American custom of eating dinner at night should not be applied to children.

That milk is very absorptive is well recognized. It is a bad precedent to store it away in refrigerators, unless it is placed in sealed jars, apart from foods which exude odor.

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[1] Horlick's Food Co. make a malted milk lunch tablet, coated with chocolate, that is nutritious and digestible. They are especially indicated when small meals should be given.

Selection can be made from the following dietary:—

TABLE NO. 31.

MORNING MEAL.

Fruit—
- Raw, stewed, or baked apple.
- Grapes.
- Grape fruit.
- Oranges.
- Cherries.
- Peaches.
- Banana.
- Stewed prunes.

Cereals—
- Hominy.
- Oatmeal.
- Farina.
- Force, or
- Wheat Flake Celery Food.

Cereals—
- Shredded wheat.
- Cream of wheat.
- Wheaten grit.
- Arrow root.
- Cerealine.
- Yellow indian meal.
- White indian meal.
- Wheat flakes.

Buttered toast.
Albert cakes
Zweiback.
Vienna bread and butter.
Stale sponge cake.
Lady fingers.

NOON MEAL.

Meat or chicken soup, thickened with lentils, peas, split peas, sago, farina, rice or egg.

Meat—
- Broiled chop, steak, or fish.
- Chicken.
- Stewed tripe.
- Sweet-bread.
- Raw scraped beef.
- Roast beef.

Meat—
- Lamb.
- Bone marrow.

Baked or mashed potatoes, spinach, peas, beans, tomatoes, cauliflower, carrots, asparagus, rhubarb, cranberries, or celery.

Apple cider, buttermilk, kumyss, seltzer, lemonade, or very weak tea.

EVENING MEAL.

Crackers and milk.
Custard.
Cornstarch pudding.
Corn muffins.
Farina pudding.
Milk toast.
Tapioca pudding.
Chicken jelly without wine.

Calf's-foot jelly without wine.
Junket.
Oysters.
Boiled, scrambled, or poached eggs.
Cream of barley.
Cream of rice.
Cocoa and milk.
Toast or crackers.

Articles of Food Which Should be Forbidden Until After the Tenth to Twelfth Year.—*Fruit:* All dried fruits (with the exception of prunes), preserved fruits, fruits out of season, over-ripe fruits or under-ripe fruits.

Meats.—Pork, ham, bacon, sausages, kidneys, duck, and goose.

Vegetables.—Cabbage, onions, radishes, cucumbers, turnips, and egg plant.

Drinks.—Coffee, tea, and ice cream soda.

All candies, cakes, nuts, pies, and salads must be forbidden.

FEEDING OF DELICATE OR SICK CHILDREN.

Infants having weak digestion or dyspeptic infants require modification of the casein in the milk. In such cases the milk should be prepared or predigested.. Sometimes dextrinizing the food will so thoroughly break up the curd of the milk and render it so finely flocculent that it will be much better adapted for a subnormal stomach.

Method of Dextrinizing.—Prepare the wheat, barley, oatmeal, or rice flour by adding a tablespoonful of the same to a pint of water, adding a pinch of salt, and boiling the same for from fifteen minutes to one hour. This will make a gelatinous solution, and hence the name of barley jelly, rice jelly, oatmeal jelly, or wheat jelly. We allow this jelly to cool, and when cool enough to be tasted we can add a diastase, such as cereo; or taka-diastase, made by Parke, Davis & Co.; or the Forbes diastase. When a small quantity of this diastase is added to the jellies above mentioned, they lose their thickness, and *become very thin.* They can easily be strained through cheese cloth, and some water added to make up for the loss by evaporation during the boiling. This jelly, or gruel, as it is sometimes called, made from either barley, rice, wheat, or oatmeal, is to be used with the milk after the diastase is added. In certain diseases, where milk is not well borne, such as dyspepsia (dyspeptic vomiting) or in summer complaint, where the giving of milk is prohibited, feeding the dextrinized gruels for several days will be found, not only very useful, but very healthful. In making this dextrinized gruel, small particles will be seen floating, which settle out upon standing. These particles consist of the cell walls and the proteids of the cereal, and cut the curds of the milk into fine pieces, when the curds begin to shrink under the combined action of rennet and acid. In using this diastase we aim at breaking up the tough curd in cows' milk by purely mechanical means.

Homemade Diastase for Dextrinizing Food.—Henry D. Chapin[1] describes a simple decoction of diastase made as follows: "A tablespoonful of malted barley grains is put into a cup, and enough cold water added to cover it, usually two tablespoonfuls, as the malt quickly absorbs some of the water. This is prepared in the evening and placed in the refrigerator over night. In the morning the water, looking like thin tea, is removed with a spoon or strained off, and is ready for use. About a tablespoonful of this solution can be thus secured, and is very active in diastase. It is sufficient to dextrinize a pint of gruel in ten to fifteen minutes."

During the summer, in the critical cases of summer complaint in which subnormal digestion existed, the author has seen very good results follow the administration of any and all of the malt extracts now in our market. Frequently the administration of a half-teaspoonful of malt extract to an infant immediately before feeding was not only relished by the infant on account of the pleasant taste of the malt, but certainly aided in the assimilation of the food. Rarely was more than three teaspoonfuls of malt ordered during twenty-four hours. Such preparations as maltine give very good results. The malt extract has a very pleasant flavor and is well borne.

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[1] Journal of the American Medical Association, July 14, 1900.

Frequently, when expense proved an important item, sufficient dextrinization of foods could be procured with these malt preparations above cited.

It is claimed by some that most malt preparations deteriorate on standing or if exposed too long; this is certainly untrue.

SUBSTITUTE FEEDING.

Gastric disturbances such as vomiting or diarrhœa contraindicate the use of milk. When colic follows the use of milk we are frequently compelled to discard milk until such acute symptoms subside. If a child has large or small cheesy curds in the stool and does not gain in weight, then the food is improper.

During acute infectious diseases, such as scarlet fever, diphtheria, or typhoid fever, we are compelled to reduce the proteid element owing to its lack of assimilation.

The food indicated is one that is very nutritious and easily digested, such as whey or sweet almond milk (see dietary). If the child is 1 year or older, soup thickened with split peas or beans, a chicken, mutton, or veal broth may be fed in three or four hourly intervals. Soup thickened with toasted bread crumbs may also be given.

For a Baby Under One Year.—When the symptoms previously described are present in an infant and milk must be stopped, trophonine, made by Reed & Carnrick, in teaspoonful doses every hour, is a valuable substitute. Whey is also indicated.

In acute milk infection and summer complaint, during my summer service at the Riverside Hospital, I have seen children retain trophonine when food containing the slightest trace of milk was rejected.

I have frequently used:—

Nestlé's Food	2 teaspoonfuls
Water	8 ounces

Warm in saucepan until it boils. Feed 3, 4, or 5 ounces every few hours.

FEEDING-BOTTLES.

A proper feeding-bottle is one that has no corners or angles on the inner surface. The bottom should be rounded so that every part of the same can be properly cleaned. Bottles that have corners and grooves will harbor bacteria.

My preference has always been for two kinds of bottles: 1. Those holding 4 ounces and graduated on one side in both ounces and tablespoons; this saves much time and trouble. 2. Bottles holding 8 ounces and divided off into 16 tablespoonfuls or 8 equal ounces.

Exactness of Ounces.—It may not be out place to ask each physician to insist on having the graduated ounces on an infant's feeding-bottle measured with an *accurate graduate,* obtainable at every drug store. In many instances the author noted feeding-bottles wherein the ounces indicated were very unequal, and one particular bottle, graduated to 8 ounces, held 12 ounces.

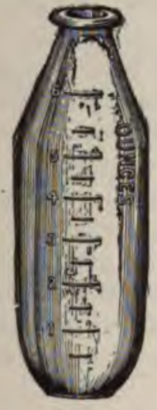

Fig. 44.

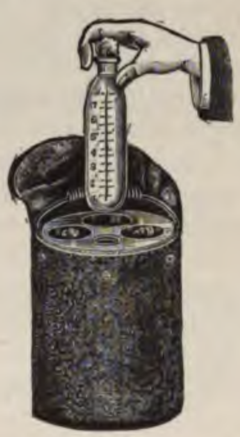

Fig. 45.

Fig. 44.—Author's Choice of Feeding-bottle.

Fig. 45.—Bottle Warmer. A convenient bottle warmer, adapted for keeping the night feeding warm, is here illustrated. It is made by the Arnold Sterilizer Co. It is also useful when traveling.

Long Rubber Tubes.—Most prominent pediatrists agree that the long rubber tubes are a convenient place for harboring micro-organisms, and they have been universally condemned.

Care of the Bottle.—Every bottle should be thoroughly cleaned with a brush and a solution of baking soda and water, a teaspoon of soda to a pint of water. The bottles must then be thoroughly rinsed with clear water. If milk has fermented or if some residue adheres to the bottle and the same cannot be properly cleaned, then boiling the bottles will be necessary. In general and for daily use the bottle need not be boiled every day.

Proper Time for Cleaning Bottles.—The best time to clean a bottle is immediately after the baby has been feed; this prevents the food souring in the bottle, and it is very easily cleaned.

The bottle brush has a long handle and bristles for cleansing the bottles. This brush should be used before the bottles are put into the soda solution.

It is understood that the *brush can itself harbor bacteria* and particles of milk removed while cleansing. It is therefore understood that the brush must be thoroughly boiled in a soda solution after each use.

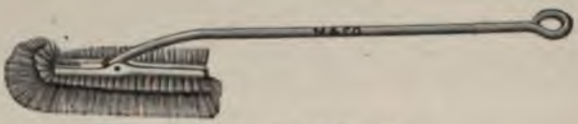

Fig. 46.—Bottle-brush.

Choice of a nipple is another important matter. My preference has always been for a black-rubber nipple, and it is a very wise point to use a nipple no longer than one week; in other words, old, worn nipples are useless for the proper management of infant-feeding. Black rubber is softer than white rubber; most white rubber is supposed to contain lead; hence a decided reason for not using it.

Nipples Recommended.—One of the best nipples made is the so-called anticolic nipple. This nipple has a ball-shaped top, which enables a baby to take a firm hold; it has three small holes, which give an easy flow of milk, and regulate a slow meal. Nipples having very large openings, which will permit a baby to finish a 6 or 8-ounce bottle of food in five or six minutes, are useless, and *this gulping of food is really the cause, or one of the causes, of infantile colic.*

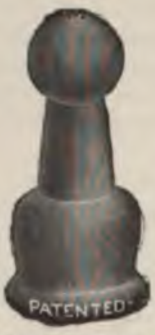

Fig. 47.—Anticolic Nipple.

I have used another nipple, but it is much harder to clean, and unless all precautions for sterilization are carefully noted it should not be used; yet, in the hands of the intelligent or where we have a trained nurse, it can be safely recommended. It is called the "Mizpah." This nipple has also a very small puncture, so that the baby gets the food slowly.

The "swan-bill" nipple and the long French nipple I also like. I have noted just as good results as with the above-mentioned kinds.

Ventilated Nipple.—A nipple very highly spoken of is the ventilated nipple made by Ware, of Philadelphia, which has a small opening or valve on the side, and, as the milk is drawn in from the bottle, it permits air to enter, thus preventing a vacuum from being formed. It is also supposed to be non-collapsible, and is highly recommended by those who have used it. The only objection—already offered—is that all nipples must not only be practical for use, but must be capable of thorough sterilization.

Cleaning the Nipples.—The prevention of stomatitis and mouth affections depend upon proper hygiene of the nipple. It does not require much time or trouble to remove the nipple from a bottle *and throw it into boiling water immediately after using.* Boracic acid or common salt may be added to the boiling water. A nipple thus treated is properly sterile.

The nipple sterilizer (see Fig. 48) is a very convenient little arrangement made by Ware, of Philadelphia. It serves the purpose admirably for the sterilization of nipples.

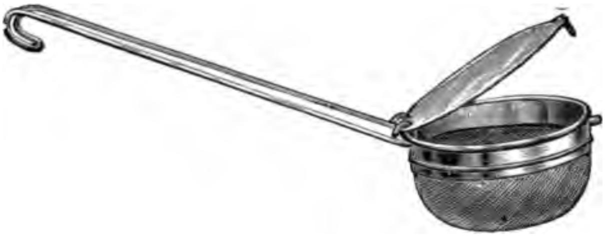

Fig. 48.—Nipple-sterilizer.

STERILIZATION OF MILK.

When Soxhlet first announced the method of sterilization, he awoke the profession to the realization of the dangers lurking in crude cows' milk. His aim was to destroy pathogenic bacteria, and give the infant a milk which did not contain living bacteria.

In order to sterilize milk according to Soxhlet, we must heat milk to a temperature of 212° F. and continue this steaming for thirty minutes. We know that heating milk produces many changes, some of which are not thoroughly understood. Other changes have been positively proven.

Changes in Milk Caused by Sterilization.—In some experiments made by Dr. E. M. Hiesland and published by Dr. B. C. Hirst,[1] it was found that by sterilization:—

1. The albumin is coagulated.
2. Casein is less readily precipitated by rennet than in normal milk.
3. Fat is freed to a slight extent; fat not freed has a lessened tendency to coalesce.

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[1] Medical News, January 31, 1891.

4. Sugar undergoes some change, as shown by its lessened dextrorotatory power.

The considerations suggested by the foregoing facts are:—

1. The coagulation of milk-albumin by sterilization may render the milk more difficult of digestion.

2. Sterilization interferes with the coagulability of milk by rennet, and presumably, therefore, with its digestibility by the gastric juice.

3. Free fat, as found in sterilized milk, is probably not readily assimilated in infant food. The fat not free, being inclosed in a less easily destructible envelope, is probably slow of digestion.[1]

On the question of sterilized milk the weight of evidence seems to show that the process, while preventing undue fermentation so changes certain of the natural ferments and some of the fats that the milk is less easily digested and less nutritious.[2]

The sterilization of milk is advocated chiefly to destroy pathogenic bacteria. The profession has been educated to the belief that we must kill all living micro-organisms in food.

When the method was first advocated, the profession adopted it in all parts of the world; so that thousands of babies have been brought up on sterilized milk. Within the last few years sentiment has changed. Sterilization accomplishes the destruction of pathogenic bacteria, but it also possesses certain disadvantages.

The spores of pathogenic bacteria cannot be destroyed by the ordinary process of sterilization.

To properly sterilize milk it is necessary to subject it to the process of tyndallization. This will render milk germ-free. This latter process consists of subjecting the milk to the process of sterilization for at least twenty to thirty minutes on three successive days. For practical purposes it is useless.

The chemical changes produced in milk by the process of sterilization are as follows: The lactalbumin coagulates at a temperature of 160° F. (70° C.). Thus the temperature being 212° F. renders this ingredient decidedly different from what it appears in its raw state; the casein is rendered less coagulable by rennet and appears to be acted upon more slowly both by pepsin and trypsin; the organic phosphorus is changed into an organic phosphate; citric acid is partially precipitated as calcium citrate, and some lime salts, which are usually soluble, are converted into insoluble compounds.

Certain changes also occur in the fat. Moreover, certain natural ferments in fresh milk, believed to be of value in digestion, are destroyed by heat.

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[1] Medical Record, February 28, 1891.

[2] North American Practitioner, June, 1892, from the "Year-book of Treatment" (Lea Brothers & Co).

Many of these changes are but imperfectly understood, and some of them are doubtless without any injurious effect upon nutrition. There is, however, one important clinical reason for believing that the nutritive properties of milk are impaired by heating to 212° F., viz., the occurrence of scurvy in infants who are fed upon such milk for a long time (Holt).

We know that a great many children fed on sterilized milk develop scurvy. The same is true of children fed on boiled milk. The reason is, Rundlett so ably says: "Changes take place, not in the albumin, fat, nor sugar, but in the albuminate of iron, phosphorus, and possibly in the fluorine, vital changes take place. These albuminoids are certainly in the milk, derived as it is from tissues that contain them, and are present in a vitalized form as proteids." On boiling, the change taking place is simply due to the coagulation of the globulin, or proteid molecule, which splits away from the inorganic molecule, and thus renders it, as to the iron and fluorine, unabsorbable and, as to the phosphatic molecule, unassimilable. This is the change that is so vital, and this only takes place when milk is boiled.

It is evident that children require phosphatic and ferric proteids in a living form, which are only contained in raw milk.

Cheadle says that phosphate of lime is necessary to every tissue; no cell growth can go on without earthy phosphates; even the lowest form of life—such as fungi and bacteria—cannot grow if deprived of them. These salts of lime and magnesia are especially called for in the development of the bony structures.

Avoidance of Scurvy.—Since clinical experience has demonstrated that the prolonged use of sterilized milk and boiled milk will produce scurvy, and that improvement is immediately noted when raw milk is given, or raw muscle juice (beef-juice) or raw white of egg, added to fresh fruit juices, does it not seem more plausible to commence feeding at once with raw milk rather than after scurvy or rickets is developed?

There is a certain deadness, or to put it differently, absence of freshness, that is lacking in milk that has been boiled or sterilized, just as it is the absence of fresh meats and green vegetables which is known to cause scurvy in the adult.

In my own practice I have so frequently been disappointed in the use of sterilized milk, that within the last few years I have entirely discarded its use.

The Disadvantages of Sterilized Milk From a Clinical Standpoint.—The first effect of using sterilized milk is that the child will be constipated. It is for this reason decidedly objectionable. It is wise to remember that one of the earliest symptoms of rickets is constipation. We have known that the prolonged use of sterilized milk results in rickets. The symptom of constipation should therefore be looked upon not as a temporary, but as a permanent damage to the body. Therefore, it should not be neglected. Appropriate dietetic treatment can easily modify constipation. Clinicians all agree that the prolonged use of sterilized milk cannot be advocated. There may be individual children who thrive on prolonged use of sterilized milk, and I dare say on any form of feeding. We are dealing, however, with average children, and these all show a certain train of symptoms.

Constipation of the most stubborn kind will be encountered in all children fed on sterilized milk. This condition exists regardless of the season of the year. Children do not thrive as well on sterilized milk as they do on milk subjected to a *much lower degree of temperature.* Sterilized milk is rendered less digestible than it is in its raw state.

Freeman[1] says that the modifications produced in milk heated to 212° F. consists in the starch-liquefying ferment being destroyed; the casein being rendered less coagulable and therefore being acted upon slowly and imperfectly by pepsin and pancreatine, and the milk sugar being destroyed.

Fayel,[2] discussing boiled milk, says that it "is more indigestible, and in no respect safer than unboiled milk. The temperature at which it boils is insufficient to destroy microbes, and the milk is therefore not sterilized. Its *density is increased* by the *boiling, above that suitable for infant digestion.*

Milk consists of a multitude of cells suspended in serum. The cells are fat cells which form the cream. The remaining cells are nucleated and of the nature of white corpuscles. The serum consists of water in which is dissolved milk-sugar and serum albumin, with various salts and chief of all casein. The cells, with the exception of fat corpuscles are all *living cells,* and they retain their vitality for a considerable time after the milk is drawn from the mammary glands.[3]

There is reason for supposing that when fresh milk is ingested the *living cells* are at once absorbed without any process of digestion, and enter the blood-stream and are utilized in building up the tissues. The casein of the milk is digested in the usual way as other albuminoids by the gastric juice, and absorbed as peptone. There is also absorption of serum albumin by osmosis. The chemical result of boiling milk is *to kill all the living cells* and to coagulate all the albuminoid constituents. Milk after boiling is thicker than it was before.

The physiological results are that all the constituents of the milk must be digested before it can be absorbed into the system; therefore, there is distinct loss of utility in the milk, because the living cells of fresh milk do not enter into the circulation direct as living protoplasm and build up the tissues direct, as they would do in fresh, unboiled milk. In practice it will have been noticed by most medical practitioners that there is a very distinctly appreciable *lowered vitality* in infants which are fed on boiled milk. The process of absorption is more *delayed and the quantity of milk* required is distinctly larger for the same amount of growth and nourishment of the child than is the case when fresh milk is used.

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[1] Paper read at Academy of Medicine, New York, May 11, 1893.

[2] Medical Age, September 25, 1893.

[3] J. L. Kerr, British Medical Journal, December, 1895.

Vaughan does not believe that milk is benefited by either sterilization or pasteurization, but such procedure is necessary when *market milk* is used, because the latter is seldom or never obtained under aseptic precautions.

Some people have an idea that it matters not how filthy a cow's milk is, or how many germs it may contain, if it be pasteurized or sterilized it then becomes a fit food for children. This is not true, because, in the first place, even *prolonged boiling does not kill the spores* of all bacteria; and, in the second place, the chemical poisons produced by certain germs are not altered by the temperature of boiling milk.

After milk has been either sterilized or pasteurized it should be kept at a low temperature before being fed to the child. This should be regarded as a necessary procedure in the preparation of infant food. The fact that milk in which the colon germ has already grown abundantly cannot, by any process of sterilization or pasteurization, be rendered fit food for children should be emphasized. *The toxin of the colon bacillus may be heated to 180° C. (356° F.) for half an hour without having its poisonous properties diminished. If clean milk be obtained and heated at 140° F. to 150° F. and then for ten to fifteen minutes kept at a low temperature until fed to the child, it furnishes the best food which it is possible for us to obtain under ordinary circumstances.*

Sterilization of Milk at 212° F. for Thirty Minutes (Soxhlet Method). —*Bottle-cleaning:* Always cleanse the bottles thoroughly before using them if they are new bottles. It is a good plan to give them one good washing by adding a pinch of bicarbonate of soda to each bottle, boiling for at least five minutes in this soda water, and then boiling for at least a quarter of an hour in ordinary water. The bottles are then turned upside down to allow the water to drain off, I then insert a large stopper of non-absorbent cotton (sterilized non-absorbent cotton from a drug store is better than the white absorbent cotton). The neck of the bottle is stoppered at least three-quarters of an inch.

Place the bottles previously filled with milk or the feeding mixture in the rack, and set the rack in the sterilizing chamber, and cover tightly with the lid and hood.

Fill the reservoir (pan) two-thirds full of water and place the apparatus over a moderate fire for one hour. If the milk is just from the cow forty or fifty minutes are sufficient (twenty minutes for heating and twenty or thirty minutes for sterilization).

The sterilizer may be used on a gas stove (turned low), kerosene stove, or upon an ordinary cooking stove; if over the last named, the griddle should not be removed. You can tell by a bubbling sound that the sterilizer is working all right. If the water is not bubbling with regularity inside, you need more heat. It must not be put on the fire without water in the reservoir and the water should never be allowed to get lower than one inch from the bottom. With proper attention as to the quantity of water in the reservoir no further care need be given to the apparatus or to the contents of the chamber, for the prescribed time.

It is not necessary to place the bottles on ice after removing them from the sterilizer, but all bottles should be placed in a refrigerator until taken out for feeding, leaving in the cotton plugs until it is feeding time. The directions sent out with some sterilizers, that milk will keep for days implies that infants' milk may be prepared for several days at once. To this I decidedly object. A great many authors have pointed out cases of Barlow's disease due to milk which had been sterilized and not used for a long time. Before feeding the bottle is to be thoroughly warmed by putting it into a small measure or bottle-holder, and heating it with alcohol or gas to about the body temperature of 98° or 100° F. Immediately before using shake the bottle, so as to mix the cream and the milk, which invariably separates in a refrigerator; remove the cotton and draw on the nipple.

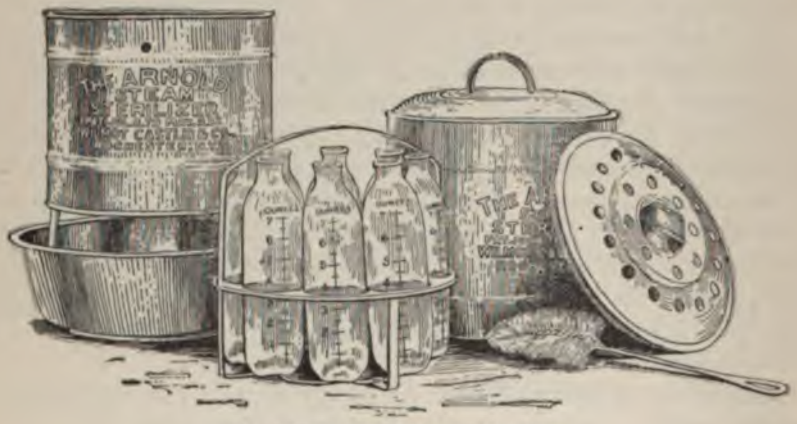

Fig. 49.—Arnold Steam Sterilizer.

PASTEURIZATION.

Heating milk to 75° C., as is done by many of the methods, does not sterilize, for the spores of the bacillus subtilis can withstand this temperature for several days. The spores will resist the temperature of 100° C. (212° F.) for six hours. Upon heating to 110° to 120° C. (230° to 248° F.)

the milk will be thoroughly sterilized, but such heating causes a browning of the milk, and the cream-cells are apt to be broken and the fat or butter will rise to the surface.

Pasteurization with a temperature between 60° and 80° C. (140° to 176° F.) destroys tubercle bacilli and, according to Van Geuns, destroys also the typhoid bacillus, the cholera bacillus, and the pneumococcus of Friedländer, and also most of the ordinary milk germs, and does not injure the milk.

C. H. Stewart gives the following interesting result of the heating of milk at various temperatures, and its result on the albumin:—

TABLE No. 32.

Time of Heating.	Soluble Albumin in Fresh Milk.	Soluble Albumin in Heated Milk.
	Per Cent.	Per Cent.
10 minutes at 60° C. (140° F.)	0.423	0.418
30 minutes at 60° C. (140° F.)	0.435	0.427
10 minutes at 65° C. (149° F.)	0.395	0.362
30 minutes at 65° C. (149° F.)	0.395	0.333
10 minutes at 70° C. (158° F.)	0.422	0.269
30 minutes at 70° C. (158° F.)	0.421	0.253
10 minutes at 75° C. (167° F.)	0.380	0.070
30 minutes at 75° C. (167° F.)	0.380	0.050
10 minutes at 80° C. (176° F.)	0.375	none
30 minutes at 80° C. (176° F.)	0.375	none

We can see that heating milk at 140° F. for ten minutes or for thirty minutes still leaves about the same proportion of soluble albumin as we find it in fresh milk. When milk is heated only ten minutes at 176° F. *no soluble albumin remains,* while in fresh milk about 0.375 is found.

An interesting bacteriological report was made on pasteurized milk by a committee representing a medical society of Washington,[1] of which the following synopsis is well worth noting:—

"The number of bacteria per cubic centimeter in pasteurized milk has been found as a rule to be less than 200. In some cases no bacteria could be detected. In four instances the number of bacteria per cubic centimeter increased to over 5000. A comparison with the number of bacteria in the sanitary milk on these same dates showed a very much larger number of germs than should have been present if proper precautions had been used. In 113 samples of sanitary milk examined, the number of colonies per cubic centimeter has in the majority of cases varied from 200 to 5000. Three samples showed over 50,000 colonies per cubic centimeter; 3 others over 20,000 and less than 50,000 colonies per cubic centimeter; 1 over 15,000 and less than 20,000 per cubic centimeter; 2 others over 10,000 and less than 15,000; 2 others over 5000 and less than 10,000.

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[1] Published in the National Medical Review, Washington, D. C., April, 1899.

"When we consider, however, that in the milk supply of our large cities the number of bacteria per cubic centimeter has been found to vary from 30,000 to 85,000,000, and has often been found as high as the number of bacteria in the sewage of several towns, namely, between 1,000,000 and 4,000,000 per cubic centimeter, the value of the number of bacteria per cubic centimeter of milk, as indicating the care which has been used in collecting and handling the milk, is at once apparent. One of the German authorities on the subject of sanitary milk (Bitter) claims that the maximum limit for milk that is fit for food is 50,000 germs per cubic centimeter. On this basis, the milk from only thirteen out of thirty-two dairies, which has been examined in Washington, would be fit for food."

There is a slight taste or flavor which is noticeable when milk is heated to 158° F. for fifteen minutes. *For practical purposes, however, milk heated to 140° F. serves very well and has no taste at all.* Pasteurization of milk has been received by the profession with the same enthusiasm as was sterilized milk when it was first announced. The mistakes that have been made by forcing infants to swallow milk sterilized at a temperature of 212° F. for thirty minutes are evident in so far as such children can show a devitalized condition into womanhood and manhood. Constipation and rickets are recognized as associate factors during sterilized milk feeding. The profession at large is rapidly departing from this improper and dangerous method of treating raw milk.

What has been said of sterilized milk applies in a lesser degree to pasteurized milk. I have frequently found cases of infants fed on pasteurized milk that showed the same symptoms, *though in a milder degree,* than what we know to be true of sterilized milk feeding.

When my advice is sought regarding the utility of pasteurizing milk, I always say: You should pasteurize your milk at a temperature of 140° to 150° F., for ten minutes, if you do not know the source of your milk supply. In New York certified milk or guaranteed milk is procured, and it is unnecessary to change the chemical character of the milk by prolonged heating. With certified milk it is simply necessary to use sterile utensils and warm the food to a little higher than feeding temperature.

TYNDALLIZATION.

When milk is subjected to a temperature of 212° F. from fifteen to twenty minutes on three successive days, such process is called tyndallization. When such a procedure is instituted, we certainly obtain the "absolutest sterility possible" of the milk.

Such milk, however, is not adapted for infant-feeding, owing to the changes brought about by this continued application of heat in rendering the albuminoids and salts contained in the milk more difficult to digest.

Milk subjected to this tyndallization has all the disadvantages of a prolonged sterilized milk or milk-mixture. My experience is decidedly against such continued heating of milk, and I am sure that many cases of scurvy can be traced to the lack of fresh albumin and casein assimilated.

The author has seen a decided improvement in children suffering with scurvy when the food was changed from *sterilized* milk to a raw-milk mixture, the milk-mixture being merely warmed to a feeding temperature.

Barlow's disease can frequently be traced to improper feeding, especially when mothers are permitted to use their experience in making up their own feeding mixtures. Children are more frequently starved than will be ordinarily admitted, and, were it possible to examine the food given to the average infant and compare it with a standard breast-milk suited for the age of the infant, we would soon learn that our crude methods resulted in positive harm, the result of which years of proper medication and feeding will hardly be able to remedy.

Figs. 50 and 51.—Pasteurizer and Sterilizer devised by Kilmer. A very practical apparatus with which I am familiar and which is well adapted for steaming milk. It can also be used for transporting raw milk by filling the compartments and surrounding the bottles with ice. The principle is the same as that used in other similar devices on the market.

The vital point to remember is to get the child properly started, and we must not be discouraged if our first feeding mixture is not properly digested or assimilated. In such instances we will soon learn which elements of our food require more proper modification and elimination, especially so if the stools are studied.

Tyndallization will permit milk to be kept for months, and is just such milk which, fed to weakened children, will ultimately cause Barlow's disease or its allied conditions. While in Berlin several years ago I was given milk which had been sterilized six months previously. While it is true the taste did not betray the length of time that the milk had been kept, it can be easily seen that certain chemical changes will develop, altering the character of the food.

It is my belief, founded on extensive experience, that sterilized milk, continually fed, to the exclusion of raw milk and raw beef-juice, will ultimately result in rachitis or scurvy.

MILK IDIOSYNCRASIES.

Some children will not tolerate milk; physicians frequently report an intolerance of milk or its dilutions in children. This condition has long been known among adults. We frequently hear adults say that milk makes them bilious; that it is not tolerated, and that they feel uncomfortable after a milk diet. While this condition is of much rarer occurrence in children, certain cases are met in which milk is not tolerated. It has been the milk itself or the component parts of the same that has disagreed in certain children under the treatment of the writer. Breast-milk and several changes of wet-nurses gave the same distressing symptoms. Cows' milk was not tolerated and was discontinued after various dilutions.

The following case will serve to illustrate what is meant by the above condition:—

CASE I.—An infant, M. L., was born in July, 1901. The weight at birth was about six pounds. The mother had no milk, so a wet-nurse was secured. The infant was wet-nursed for the next three months. The child gained about eight ounces per week during the month of July, but in August and September it did not thrive.

History of Food After Weaning.—When the child was weaned, in October, it was given condensed milk, one drachm to twelve drachms of sterile water, to which one drachm of lime water was added. The child vomited and had eructations, although it had from one to two yellowish stools per day. When this child was weaned it was constipated and required an enema of plain water to relieve the bowel. The stools during the summer months contained a great deal of mucus which was shredded and yellowish-green in color. The infant was colicky; the stools had a very sour smell; the child frequently had an explosive vomit. The condensed milk was continued through the month of October, and, as the child did not seem to thrive, it was given Just's Food. This the child refused, so Nestlé's Food was substituted and seemed to agree. When milk was added the child vomited a sour-smelling liquid, and later on refused the Nestlé's Food. As there was constant anorexia, the child was next fed with Ridge's Food. As this was not very well borne, a trial was made of Allenbury's Food. When this disagreed, the child was placed on Eskay's Albuminized Food. This also was not tolerated and the child was given some strengthening meal. This was not borne any better.

Examination.—On November 24, the child weighed about nine pounds. It had lost eight ounces the week previous to its parents consulting me. This loss of weight disturbed the family and caused them to seek a change of diet. The examination of the child showed some very interesting facts. First, the general appearance of the child was one of an undersized, undeveloped, markedly rachitic baby; there were beaded ribs; the ends of the long bones, particularly the radius, ulna and femur were markedly rachitic. Subluxation of the knee-joints was present. The head of the child was very rachitic; the fontanel was very widely open; in fact, the fontanel was three times the size of that of a normal baby. The extremities were extremely cold; the circulation was very poor; the action of the heart was very feeble; a blowing murmur was distinctly heard at the apex and could also be heard in the vessels of the neck. It was a distinct hæmic murmur and attributed to the profound anæmic condition which existed.

The trained nurse in charge of the case had been with the baby since birth and had stated that the child had had a series of spasms which were not only regular, clonic and tonic contractions, but they occurred once every twenty-four hours at a certain time of the day. The child was very fretful, very nervous, constantly irritable and had had very restless spells at night which disturbed its sleep. There was a slight eruption around the anus; the child had difficulty in taking the nipple as well as nursing at the breast.

An examination of the throat showed congenital adenoid vegetations. This latter condition interfered with the child's proper feeding; it prevented the child from properly taking its food and breathing at the same time. It would take the nipple or the breast and then let go, in order to breathe. Spoon feeding was resorted to when the child would not take food from its bottle. Attention was directed to the rhino-pharynx. By gradual cauterization the child's condition was so markedly improved that its general condition, with the appetite, stools, sleep and weight, all assumed normal tendencies.

Dietetic Treatment.—The child was given the following:—

℞ Whey	2 ounces
Milk	2 1/2 ounces
Peptogenic powder	Half a measure of the metal cap
Granulated sugar	Half a teaspoon

Mix the above and peptonize the milk by a slow process for about ten minutes and when cooled to the proper feeding temperature feed the above quantity every three hours.

The child took the bottle very well; in fact, took four ounces, retained the food and seemed to like it. The following are the nurse's reports:—

"November 24, 10.30 P.M., took four ounces, has not vomited, seems to like food."

"November 25, 4 A.M., took four and one-half ounces of food, retained. At 7 A.M. took nearly four ounces, retained. At 11 A.M. child crying and abdomen distended, child appears colicky."

A warm enema consisting of two pints of chamomile tea was ordered so that the colon and rectum were thoroughly flushed. The child was instantly relieved after some cheesy curds and mucus, plus fæces, were washed away. These fermentative conditions, resulting in gaseous eructations, colicky, distended, tense abdomen, with crying and occasional cheesy, curdy stools, the temperature frequently reaching 101 to 103 in the rectum, occasional vomiting and disturbed appetite were invariably noticed when milk, peptonized or predigested or in any form, was given to this child.

It was therefore apparent to me that this baby would not digest milk and hence some other form of feeding was required. On December 17th a new form of feeding was commenced which is known as a modified form of malt soup. A similar plan of feeding is used extensively abroad, at the foundling asylums which I visited; notably at the New Berlin Foundling Asylum, which is under the supervision of Dr. Finkelstein. This food is known as Keller's malt soup. Its preparation is rather difficult unless performed by a competent chemist. This food has been used for many years in the nursling pavilion of the Kaiser and Kaiserin Friedrich Children's Hospital, under the direction of Professor Baginsky.

I am indebted to the New York Walker-Gordon Laboratory for great care in the preparation of this food, which has certainly served me very well. The following formula was used in the beginning and was changed, as can be seen by studying the accompanying table.

KELLER'S MALT SOUP.

Take of wheat flour 2 ounces and add to it 11 ounces of milk. Soak the flour thoroughly and rub it through a sieve or strainer.

Put into a second dish 20 ounces of water, to which add 3 ounces of malt extract; dissolve the above at a temperature of about 120° F. and then add 2 ¹/₂ drachms of 11 per cent. potassium bicarbonate solution.

Finally, mix all of the above ingredients and boil. This gives a food containing: albuminoids, 2.0 per cent.; fat, 1.2 per cent.; carbohydrates, 12.1 per cent. There are in this mixture 0.9 per cent. of vegetable proteids.

TABLE NO. 33.—*Food Ordered at Walker-Gordon Laboratory. Delivered Daily as Ordered Below for Case 1.*

Date.	No. of Tubes.	Oz.	Dex. Wheat Oz.	Milk. Oz.	Water. Oz.	Malt. Ext. Oz.	11% Pot. Bicarb. Sol. Dr'm.
December 17, 1901 . .	4	3	1	5½	10	1½	1¼
	4	3	Same (but without wheat).				
December 20, 1901	8	3	Same (but with dextrinized wheat).				
December 24, 1901	8	3½	Same.				
January 4, 1902	8	4	Same.				
January 9, 1902	5	4	Same.				
January 12, 1902	8	4	Same.				
January 21, 1902 . .	4	4	Same.				
	4	4	Same (but ½ oz. more milk to each tube).				
February 7, 1902 . . .	8	4	2	15	16	3	2½
February 18, 1902 .	4	4½	1	9½	8	1½	1¼
	4	5	1	11½	8	1½	1¼
February 22, 1902 . .	4	4½	1	9½	8	1½	1¼
	4	4¾	1	10½	8	1½	1¼
March 1, 1902 . .	4	4½	1	2	15½	1½	1¼
	4	4½	1	0	17½	1½	1¼
March 8, 1902 . .	4	4½	1	3	14½	1½	1¼
	4	5	1	4	14½	1½	1¼
March 6, 1902 .	4	5	1	3	14½	1½	1¼
	4	5	1	4	14½	1½	1¼
March 10, 1902	8	6	2½	20	26	3¾	3½
March 17, 1902 . .	4	6	1¼	10	13	2	1¾
	4	6	1¼	8	15	2	1¾
April 1, 1902	8	6	2½	24	22	4	3½
April 13, 1902	6 [1]	4					
April 16, 1902	8	4½	2¾	14	21	3½	2¼
April 18, 1902	8	4½	3	16	21	3½	2¼
April 22, 1902	8	5	3	16	21	3½	2¼
April 26, 1902 . . .	8	6	3	16	21	3½	2¼
May 2, 1902 . . .	8	6	3¾	24	26¼ [2]	4½	2¾
May 21, 1902 . .	4	6	1¼	12	12 [3]	1¾	2
	4 [4]	6					
May 23, 1902	8	6	2½	24	24	3½	4

[1] Each Cube of 4 oz. Distilled Water and 3 dr. Nestlé's Food.

[2] Barley Water.

[3] Distilled Water.

[4] 1¼ oz. Nestlé's, ¼ oz. Malt Extract and 24 Distilled Water.

The wheat flour is necessary, as otherwise the malt soup would have a diarrhœal tendency. The alkali is added to neutralize the large amount of acid generated in sick children. Biedert emphasizes the importance of giving fat, rather than reducing its quantity, in poorly-nourished children, and cites the assimilability of his cream mixture or of breast-milk in under-fed children as proof of his assertions. The author has used this malt soup most successfully in the treatment of athrepsia (marasmus) cases in which the children were simply starved.

On studying the ingredients one can easily see that the malt extract and the dextrinized wheat are highly nutritious agents. We know that dextrinized wheat is very well absorbed by some of the youngest infants. The addition of the potassium bicarbonate served to render the food markedly alkaline, which is an extremely important thing. When milk was added with the object of increasing the percentage of fat and proteid, we deviated from the quantity as originally recommended by Keller. Colic and gastro-enteric fermentation was invariably encountered. A study of the weight chart is extremely interesting.

CASE 2.—The child, S. N., born of healthy parents, was put to the breast on the second day after birth. On the third day after birth there was a profuse flow of milk. The infant appeared quite well satisfied after nursing.

The child was nursed every two hours; was changed from the right to the left breast at every other feeding. Fifteen to twenty minutes after each nursing there were symptoms of restlessness and constant crying. The legs were flexed on the abdomen; there were eructations and all the evidences of colic. The child cried at least one hour, until it fell asleep from exhaustion. This state of affairs continued each day for at least two weeks. A specimen of breast-milk was examined by a chemist and found to be perfectly normal in its elements and in their relative percentages.

The family was greatly distressed at its continued crying and apparently colicky

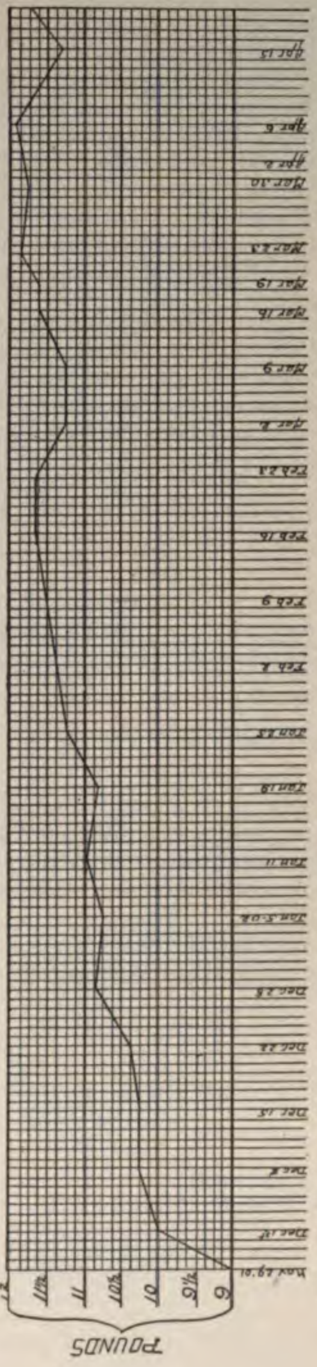

Fig. 52.—Weight Chart of M. L.—Case 1. Two lower incisors appeared about seven months, showing excellent progress.

condition, but was surprised, in spite of this condition, to find that the infant gained between four and six ounces. It was necessary to give 1 to 2-grain doses of chloral hydrate at night to procure sleep. We finally decided to change the mother's milk and to substitute a wet-nurse. The child behaved just as badly with the wet-nurse, had the same crying spells shortly after nursing, which continued frequently for one hour. When the breast was discontinued for one day and barley-water or albumin-water substituted, the child would appear comfortable, and not have the pains which we noted while feeding breast-milk.

The stool was filled with large cheesy, curdy masses. To aid the assimilation of the milk, small doses of pancreatin and bicarbonate of soda were given; with the idea of partially peptonizing the milk, essence of caroid, a half teaspoonful before each feeding, was also prescribed. In addition thereto small quantities of essence of pepsin and hydrochloric acid were given after each feeding, to aid the digestion of this food. Neither of these medications relieved the condition and I finally decided that the breast-milk was not adapted for this child. We next resorted to very diluted cows' milk, using one part milk with three parts oatmeal water. We gradually increased the strength until one-half milk and one-half oatmeal water was given.

TABLE NO. 34.—*Case 2.*

Date.	No. of Tubes.	Oz.	Dex. Wheat. Oz.	Wh. Milk. Oz.	Distilled Water Oz.	Barley Jelly. Oz.	Malt Extract. Oz.	11% Pot. Bicarb. Sol. Dr'm.
May 28, 1902	7	6	1¼	14	28	. . .	8	8½
May 29, 1902	7	6	1½	24½	17½		2	8½
May 30, 1902	7	7½	1½	35	14	3½	2	8½
May 31, 1902	10	7½	2¼	52	21	5¼	3	5¼
June 2, 1902	7	7½	1½	35	14	3½	2	8½
June 5, 1902	7	7½	1½	35	14	4	. . .	8½

Milk, however, in any form, whether diluted or pure, was poorly borne. When cereal decoctions were substituted, they were invariably better tolerated. The same was true when soups and broths were given. The latter were always well borne, and the moment milk was added, no matter in what form, trouble was immediately encountered.

An interesting point is the fact that all infants having the milk idiosyncrasy had elevated temperatures ranging from 101 to 102 continuously.

CHAPTER IV.

LABORATORY MODIFICATION OF MILK.[1]

It is now several years since a Walker-Gordon milk-laboratory was established in New York. Their method of feeding infants is based on mixing the ingredients in such combination that, when combined, they should resemble certain chemical formulæ of breast-milk at various ages. Blanks are given the physician, which are filled out according to the individual requirement. The age and weight are noted. Fat, sugar, proteid, and water are prescribed in percentages. We are therefore able to state that the food ordered contains a definite percentage of fat, sugar, caseinogen, and lactalbumin. The same is also true regarding the heating of food. We can prescribe the food sterilized, pasteurized, or raw. A great many changes can be made. We can increase or decrease the fat; the same is true of sugar and proteids.

My advice to those using modified milk is to begin with *low proteids.* An infant at birth, if deprived of breast-milk, should never receive more than 0.50 per cent. of proteids, in the beginning of laboratory feeding. Some infants do very well on 0.25 per cent. of proteids soon after birth. It is a simple matter to note the infant's condition, its stools, its sleep, and its weight.

If the above-named conditions are satisfactory, then we can increase the proteids, the fat, and the sugar. Note conditions every day, and have the mother or nurse in charge of the infant report the slightest disturbance. Vomiting, if present, its frequency and character, should be carefully noted. So also should colicky symptoms, eructations, flatulence, and greenish, curded stools.

Constant crying, disturbed sleep, and restlessness are all factors that need correction and supervision.

The quantity of food prescribed depends upon the requirements of each child. Some children can take 3 ounces at one feeding while others appear satisfied after taking 2 ounces of food.

Examples.—For a child at birth:—

Fat	2.00	Formula I
Sugar	5.00	
Proteids	0.50	
Lime-water	5.00	

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[1] Reprinted from "Infant Feeding in Health and Disease." Louis Fischer, M.D. Third Edition. F. A. Davis Co., 1903.

Or:—

Fat	2.00	Formula I*a*
Sugar	5.00	
Proteids	0.75	
Lime-water	5.00	

Milk, raw, pasteurized, or sterilized.

Quantity of food to be given, 2 ounces every two hours.

My preference for food prescribed at a laboratory where *germ-free milk* is obtainable is to prescribe it raw. When constipation is encountered the raw milk will modify such conditions.

If diarrhœa or looseness exist, then my preference is to use heated milk: sterilized from ten to twenty minutes.

If the infant thrives, the ingredients can be increased; also the quantity at each feeding:—

Fat	2.50	Formula II
Sugar	6.00	
Proteids	1.00	
Lime-water	5.00	

Later, if conditions warrant it:—

Fat	3.00	Formula III
Sugar	6.00	
Proteids	1.50	
Lime-water	5.00	

In this manner we can gradually increase the percentage of ingredients until whole milk is ordered.

When abnormal conditions prevail—such as loose bowels—then barley water can be substituted for the sterile water.

CASE I.—The following formula was recently prescribed at the laboratory for a child, 1 year old, with very loose bowels:—

Whole milk	15	ounces
Rice-water	14	ounces
Dextrinized wheat	1	ounce
Dry cane-sugar	1½	ounces
Cornstarch	2	teaspoonfuls

To be thoroughly mixed, sterilized 20 minutes, and divided into five feedings, each bottle containing 6 ounces.

NOTE.—Successful laboratory feeding will only be accomplished when the physician is willing to supervise the products of metabolism and increase or decrease the ingredients demanded by individual symptoms. For example: hard, dry stools, more fat; a very anæmic condition, more proteids and fat; a restless hungry child immediately after feeding demands a larger quantity of all ingredients.

When the bowels acted better, and had a more solid consistency, I added malt extract, $^1/_2$ teaspoonful to each bottle. When improvement was noted the above formula was changed to:—

Whole milk	28 ounces
Barley-water	20 ounces
Cornstarch	1 ounce
Dry sugar	6 drachms
Dextrinized wheat	2 $^1/_2$ ounces

Sterilize, divide into eight bottles of 6 ounces each.

The following case illustrates SUCCESSFUL MODIFIED MILK FEEDING WITH MILK PREPARED AT WALKER-GORDON LABORATORY.

CASE II.—*Baby A.*, four months old, was seen by me September 19, 1901, with the following history: It was the first baby, forceps delivery, podalic presentation; weight at birth, about 6 pounds. Family history excellent. Nursed at mother's breast about four weeks, but, owing to a scanty flow of milk, she required additional hand-feeding. The baby received milk and barley water, sterilized or boiled. A bottle was given after each nursing (so-called mixed feeding).

Result: Constipation; relief given by soap-suds enema. This condition lasted about six weeks. The child had colic of a very severe form and also tenesmus: *i.e.*, constant straining.

Child was weaned of the mother's breast; food ordered was:—

Milk	8 ounces
Barley-water	16 ounces
Milk-sugar	3 teaspoonfuls
Lime-water	2 teaspoonfuls
Salt	10 grains (pinch)

Sterilize thirty minutes, divide into eight feedings, and feed every two hours.

When about two months old, child had greenish, spinach-like, very slimy stools, also *containing white curds*. The infant appeared hungry or thirsty all the time, was restless, had insomnia, and suffered with colic. There was no vomiting. A physician ordered the milk discontinued and barley-water given instead. The child became extremely emaciated; hence was removed to the seashore. At the seashore Dr. J. ordered:—

Milk	1 ounce
Boiled water	3 ounces
Milk-sugar and salt.	

This food was quite well tolerated. When oatmeal-water was given instead of barley-water, to offset the constipating effect, a miliary eruption appeared.

During the second week of September the child still had diarrhœa. Stools still greenish, containing mucus and shreds. The rectum prolapsed from constant tenesmus. Cereal milk was tried, but with no success.

The above is the clinical history given to me by the mother of the infant.

Present condition: A very frail-looking infant, rather emaciated. Poor circulation, cold extremities, pallor of skin, anus slightly excoriated, and nævus on right side of thorax.

Temperature normal in rectum, 98 4/5° F.; pulse, 120; respiration, 28. Throat normal, tongue moist and has grayish-white, fur-like coating. Heart-sounds feeble; slight bronchitis, diffuse sonorous and sibilant râles heard on both sides of the chest. Stomach very markedly distended. Abdomen tympanitic on percussion. Colon distended. Liver enlarged. Spleen not palpable.

Diagnosis: Chronic dyspepsia, atrophy due to mal-assimilation of food, and rickets.

Prognosis: Fair.

TABLE No. 35.

WEIGHT.

September 19	8 lb. 15 oz.	(including shirt and belly-band)
September 25	9 lb. 12 oz.	" " " "
Gained	13 oz.	
October 2	10 lb. 2 oz.	" " " "
Gained	6 oz.	
October 9	10 lb. 9 oz.	" " " "
Gained	7 oz.	
October 16	11 lb. 2 oz.	" " " "
Gained	9 oz.	
October 23	11 lb. 14 oz.	" " " "
Gained	12 oz.	
October 30	12 lb. 6 oz.	" " " "
Gained	8 oz.	
November 30	15 lb. 7 oz.	" " " "
With clothes.		

A study of the weight-chart will prove very interesting.

The dyspeptic and rachitic baby with cold extremities is to-day a beautiful child, well developed, and was not seen by the author for several months—until it was necessary to vaccinate.

Ordered: Syr. rhei arom., ʒj every four hours, to cleanse gastro-intestinal tract.

Also:—

℞ Strychnine sulphate	0.002
Sacchar. alb.	0.06
Decoction of cinchona (flava)	60.0

M. Teaspoonful after feeding three times per day.

The above as a cardiac and vascular stimulant.

September 20th: Food ordered at Walker-Gordon laboratory:—

Fat	2.50
Sugar	6.00
Proteids	1.50
Lime-water	1/16

Seven feedings of 6 ounces each. Use raw milk. Feed every two and one-half hours.

The following day the child slept from 8 P.M. till 4 A.M.—eight hours continuously. Had three pasty stools. Infant appeared satisfied after bottle. It was then ordered (September 22d):—

Fat	3.0
Sugar	6.0
Proteids	2.0

No alkalinity.

Raw milk. Seven feedings, 6 ounces in each.
Feed every two and three-fourths hours.

Child seemed much better satisfied after feeding; vomited once; had two stools, both of yellowish color, and of good consistency. One stool at 5 A.M. and one at 5 P.M.

September 28th:—

Fat	3.50
Sugar	6.00
Proteids	2.00

Pasteurize the food. Six feedings of 6 ounces each. Feed every three hours.
When bowels acted too frequently I pasteurized the food; not otherwise.

October 6th, ordered: Bran and sea-salt baths every second night; temperature of bath 95° F.; followed by brisk rubbing to stimulate the circulation. The digestion of the infant being excellent, stools regular, the percentage of ingredients was increased:—

Fat	4.00
Sugar	6.00
Proteids	2.50

Use barley-jelly instead of water; alkalinity, 5 per cent. Heat to 167° F.
Six feedings, of 6 ounces each.
Feed every three and one-half hours.

Child is excellent, gaining in weight; sleeps well; stools normal; has no colic. Discontinued laboratory feeding.

Home modification:—

Pure raw cows' milk	30 ounces
Barley-water	18 ounces
Peptogenic powder	3 teaspoonfuls

Divide into six bottles; warm each bottle before feeding.
Feed every three and one-half hours.

Add the barley-water to the raw milk and divide into six equal bottles, then place in refrigerator until feeding-time. At feeding-time empty a bottle into a clean saucepan, add the peptogenic, and warm to the temperature of 100° F. for ten minutes; then boil quickly for one minute and cool to feeding temperature.

For the relief of constipation:—

Infus. senna comp.	2 ounces
Saccharin	1 grain

M. Teaspoonful every three hours until bowels move.

After a few days abstracted one ounce of barley-water and added one ounce of pure milk, until after a few weeks the child received whole milk, sweetened with one teaspoonful of granulated sugar; 8 ounces every four hours.

Also ordered six ounces of chicken-soup; steak-juice, gradually thickened with cereals; some egg-crackers, zwieback, and bread crumbs in soup.

Later:—

Milk (raw)	8 ounces
Cream	1/2 ounce
Granulated sugar	1 teaspoonful

Warm in a saucepan and feed every four hours.

ILLUSTRATIVE CASE—UNSUCCESSFUL LABORATORY FEEDING.—N. R., a healthy female, was put, soon after birth, on modified milk.

October 14th: Fat, 2.0; milk-sugar, 5.0; albuminoids, 0.75; lime-water, 1/16. Eight feedings; 2 ounces in each.

October 17th: Constipation. Fat, 2.5; milk-sugar, 6.0; albumin, 1.0; lime-water, 1/16. Nine feedings, 2 1/2 ounces in each.

October 27th: Fat, 3.0; milk-sugar, 6.0; albuminoids, 1.0; lime-water, 1/16; barley-jelly, 1/15. Ten feedings; 3 ounces in each.

November 5th: Fat, 3.5; milk-sugar, 6.0; albuminoids, 1.0; lime-water, 1/16; barley-jelly, 1/15. Ten feedings; 3 ounces in each.

November 17th: Fat, 4.0; milk-sugar, 6.0; albuminoids, 1.5; lime-water, 1/20; no barley. Ten feedings; 3 ounces in each.

November 19th: Curded stools, dyspeptic diarrhœa. Fat, 4.0; milk-sugar, 6.5; albuminoids, 1.0; lime-water, 1/20. Ten feedings; 3 ounces in each.

The child did not increase in weight, had a rectal temperature of 100°, slightly furred tongue, vomited curds, had greenish stools containing undigested particles of fat and true casein and large masses of mucus. The diagnosis of dyspepsia infantum was made; hand-feeding was stopped, the child's alimentary tract was cleaned by giving cascara sagrada, and a proper wet-nurse was secured. The infant at this time was about six weeks old. The child nursed very well, and after a few days the stools were normal, both in consistency and color. The infant gained steadily from 4 to 6 and sometimes 8 ounces per week, until she was seven months old, when suddenly the weight remained stationary. The child was bright and cheerful, but I deemed it necessary to have the milk of the wet-nurse examined by a competent chemist; a specimen of the same was secured in the usual manner described by me in a previous section on "Specimen of Breast-milk for Chemical Examination." This specimen was examined for the author by John S. Adriance, the chemist of the Nursery and Child's Hospital, who reported the following:—

Fat	2.00 per cent.
Sugar	7.43 per cent.
Proteids	0.88 per cent.
Ash	0.16 per cent.
Total solids	10.47 per cent.
Water	89.52 per cent.
Specific gravity at 70° F.	1031

Reaction alkaline.

In the chemical result above given it is very evident that a deficiency in the proteids exists; hence it accounted, not only for the stationary weight, but for the late dentition. The child did not gain an ounce in one month. We discharged the wet-nurse. The following food was ordered:—

Milk	3 ounces
Cream	2 teaspoonfuls
Oatmeal-jelly	3 ounces
Lime-water	1 drachm
Milk-sugar	1 teaspoonful
Salt	1 pinch

Pasteurize the above and feed every three hours, the above quantity being for one feeding.

After the infant had taken this food for six days it was cheerful, had had one and two yellow stools daily, and gained 6 ounces in six days.

The above case will illustrate:—

1. That the child was decidedly dyspeptic while taking its modified milk for about six weeks.

2. That for about six months the infant thrived very well on the milk of a wet-nurse.

3. That the stationary weight of the infant and the chemical examination of the milk of the wet-nurse showed deficient proteids, which accounted for this non-increase in weight and the lateness in dentition.

4. That a proper milk-mixture, which agreed very well, suited the requirement of this infant, and emphasizes the fact that we must individualize in each and every case.

It is impossible to make an emulsion like milk from its component parts by a synthetic process. Let it therefore be distinctly understood that, once a milk emulsion is broken up, as is done in centrifuging milk and removing the cream, mixing the whole will never restore the uniformity of the emulsion that existed prior to this division.

In domestic modification, of course, the same care must be taken to secure clean, pure milk and cream from healthy, well-kept cows. This is quite possible now in New York, and is becoming easier each year, as more attention is being given to infant-feeding and greater demand is being made for a pure milk supply. Pasteurization is as readily done in the nursery as in the laboratory. Accurate measurement of quantities and cleanliness of vessels and feeding-bottles is equally possible and, in my experience, quite as certain at home as in the shop.

Clinical experience has demonstrated the fact that some children will thrive on condensed milk in spite of faulty hygiene, while others will not thrive in the best environment with the best form of feeding; again, some children will thrive on modified milk, others will not. Some cases seen by the author suffered with intense constipation, having clay-colored stools. In one instance, in which two children in one family were constantly fed on modified milk of varying proportions, the formulæ were changed at least a half-dozen times with the usual increase of fat and sugar and lowering of the proteids, and in spite of this fact, after repeated trials, and no benefit, this feeding method was abandoned. A child recently seen by the author *did not gain 1 ounce* **in** *four months.* This was one of the reasons that prompted the family to change both the physician and the food. The child, about 2 years old, was very pale, restless at night, quite peevish during the day, and decidedly backward in development. It could neither speak nor walk, although the teeth were well developed. From the time the modified milk was discontinued, and a nitrogenous diet given, the infant improved, and from last reports is quite well developed.

Do not let us blindfold ourselves with the belief that an infant is thriving unless our baby shows a regularity in the increase of weight, sleeps well at night, for at least from six to nine hours continuously, and, above all, assimilates its food, as evidenced by regular, unaided movements of the bowels; such movements should be once or twice in twenty-four hours, have a yellowish-white color, and a mustard-like consistency. If the stool is hard or lumpy or pasty, like putty, then it is certainly abnormal, and shows improper food. The same is also true if the stool contains white particles of cheesy curds, showing a casein indigestion. In one infant, which had taken modified milk continuously for seven months, an obstinate constipation was only relieved after full doses of codliver-oil and extract of malt were given for several weeks—aided by massage, besides changing the diet.

It is therefore very necessary to continually watch the baby, and when abnormal conditions such as anæmia prevail, it is wise to give restoratives for a long period in addition to the food. Note if the food is deficient in its nutritive elements, and, if so, change the formula so as to adapt it to the baby. *Do not give medicine* when the quality or quantity of food is deficient. *Remedy the food first;* then, if not satisfied, give medication.

Pallor of the Skin.—An unusual pallor of the skin, and also of the conjunctival mucous membrane, has frequently been noticed in modified milk babies. In one instance an extreme leucocytosis was noticed for the treatment of which iron was given. An examination of a drop of blood showed a diminution of the red blood-corpuscles and an excess of the white blood-corpuscles. A decided hæmic murmur was noticeable in the vessels of the neck, in a child, two years old, which had been fed continually on modified milk.

Craniotabes, softening of the cranial bones, as well as very late closing of the anterior fontanel has also been observed in some children fed with this form of food.

A boy, 4 years old, a typical Walker-Gordon baby, who was fed exclusively on modified milk, now shows knock-knees, besides having been under the treatment of his physician for a general furunculosis of the scalp. The furuncles were of such a size that they required several incisions; others opened spontaneously.

Sometimes predigested food is ordered with the addition of peptogenic powder, the predigestion to be done at the laboratory. A great many physicians who formerly condemned percentage feeding have become converted to this method.

Constipation, which is frequently encountered, can be remedied if the chemical and clinical causes are considered. Superheated milk is one of the main causes. In spite of the many failures reported by feeding sterilized milk, we see hundreds of babies brought up on this line of feeding.

Chemical changes are produced by subjecting the milk to a temperature of 212° F. for thirty minutes and frequently forty-five minutes. These changes take place, in the most vital elements of milk, such as albuminate of iron, phosphorus, and possibly in the fluorine. *These elements are present in a vitalized form,* as they are derived from *tissues that contain them. When we consider that children require* phosphatic and ferric proteids in a *living form,* then we cannot continue with boiled or sterilized milk-feeding for a too prolonged period without causing structural weakness.

There are times when raw milk will cause too frequent stools; then it may be advantageous to resort to pasteurization or to heating the milk to 167° F. for about twenty minutes.

I am convinced that prolonged, sterilized milk-feeding will result in rickets. I have had many cases of weak spine and bony structure in which nothing but *improper food* could be regarded as the etiological factor. These children were among the well-to-do, among whom excellent hygiene and proper nursing habits were rigidly enforced. Improvement was noted when sterilized milk was abandoned and raw milk food, in addition to raw muscle juice, grape juice, and orange juice, was prescribed.

A great many unsatisfactory reports are heard regarding laboratory feeding. Some condemn laboratory feeding because it is patented. Others condemn the method after noting poor results.

More recently the author has tried *raw milk* and cream modified at the laboratory, and has noted a great difference in the assimilation of such modified milk. Thus, while some experience herein reported has been bad, it is possible that a good part of the fault is due to overheating the milk. Changing the character of the proteid and altering the chemical relationship of the various ingredients must change its assimilability, and hence the author would urge those who use the laboratory to insist upon having formulæ compounded by using raw milk and fresh cream.

CHAPTER V.

OTHER SUBSTITUTE FOODS.

GOATS' MILK.

MY experience with goats' milk has been rather good. The following case will serve to illustrate the manner in which goats' milk was used:—

An infant, seven months old, was seen by me in consultation. She could not digest cows' milk, but suffered vomiting, with intestinal colic, and had cheesy and curded stools. When goats' milk was given in the same quantity as cows' milk, the acute indigestion subsided.

In a second case, an infant, one month old, vomited whenever cows' milk was given, and suffered with dyspeptic catarrh. The symptoms subsided when the infant was put to the breast of a wet-nurse. After several months wet-nursing the infant was again given cows' milk, and again the symptoms returned. As we could not procure a wet-nurse, goats' milk diluted with rice water, using four ounces of goats' milk with four ounces of rice water, and one teaspoonful of sugar, was given. The child, six months old, was fed once every three hours. After one week's feeding we increased the quantity of goats' milk to five ounces and decreased the rice water to three ounces. When the child was nine months old pure goats' milk, pasteurized for ten minutes at a temperature of 158° F., was fed, with very satisfactory results. The child gained in weight and had yellowish stools.

Barbellion[1] has for years been an ardent advocate of the introduction of goats' milk for infants and invalid diet. He describes tests which show that the coagulum is soft and very soluble, like that of human and asses' milk, while the coagulum from the cows' milk is more compact and difficult to digest. Comparative tests with gasterin showed that while cows' milk was scarcely affected by it during twenty hours, human, goat, and asses' milk were completely digested.

He reports a number of cases showing the remarkable manner in which infants thrive on goats' milk. The Academie voted in favor of his conclusions as to the advisability of establishing numerous goat milk depots throughout the city. One of the principal advantages of the goat for this purpose is that it is refractory to tuberculosis.

BUTTERMILK FEEDING.

A very elaborate paper on the subject of buttermilk feeding, by Dr. Teixeira de Mattos, of Rotterdam, has recently appeared.[2] He cites de

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[1] Goats' Milk for Infant Feeding. Barbellion (Paris). Bulletin de l'Academie de Médecine (Paris).

[2] Jahrbuch für Kinderheilkunde, January, 1902.

Jager, who published a paper[1] recommending this form of feeding; Karger[2]; Houwing[3]; and private and public reports of Schlossmann, Heubner, Soltmann, Finkelstein, de Mattos, and others.

While practically unknown one year ago, it is now pushing its way forward. In Holland this dietetic treatment is very popular.

Buttermilk feeding of children is by no means new, having been used in 1790 by P. Campert (cited by Biedert). Very little appears in literature about this article of diet until in 1865 Dr. Ballot, of Holland, again revived and recommended it.

To Prepare the Food: Take 1 quart (liter) of buttermilk; add 1 even tablespoonful of rice, wheat, or other flour desired (about 10 to 18 grams); heat the mixture over a small gas fire, with constant stirring, until it has boiled up three different times (requiring about twenty-five minutes); then add 2 or 3 tablespoonfuls (about 70 to 90 grams) of cane sugar or beet sugar. It is better to use new enameled ware or agate ware for preparing this food. The food as above prepared assumes a yellowish color.

It is necessary to have wide mouths for the bottles as the food coagulates and gets lumpy, in which event it would require occasional shaking to bring the thickened portion to the proper consistency.

De Mattos reports a series of cases in which buttermilk was used. The bulk of these cases were anæmic, atrophic cases requiring restorative treatment. In all cases reported the weight was increased and dyspeptic symptoms, when present, rapidly disappeared.

The increase in weight noted by de Mattos was from 500 to 700 grams weekly in debilitated children, and Schlossmann reports as much as 700 grams increase in six days.

Graanboom, in his book on "Diseases of the Digestive Tract in Children" (1901), states that he also is very much impressed with the value of buttermilk as an infant-food.

De Mattos states that children so fed for a period of six to eight months show signs of rickets or late dentition, although they look well and appear to be well nourished. Whether other methods are worse he does not state.

Lactic acid was never found in the urine of infants fed either with lactic acid or its salts. This series of experiments was made by de Mattos, and the results were corroborated by Houwing.

The amount of lactic acid present in buttermilk has been carefully studied. Robertson, a chemist, found it to be:—

Minimum	0.09 per cent.
Maximum	0.45 per cent.

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[1] Nederlandsch Tydschrift voor Geneeskundigebladen, October, 1895.

[2] "Die Verdauung und assimilation des Gesunden und Kranken Sauglings, nebst einer Rationellen Methode zur Seuglingsernährung," Berlin, 1898.

[3] Centralblatt für Gynäkologie, 51, 190.

De Jager believes that good buttermilk does not contain more than 0.5 per cent. of free lactic acid.[1] These are, however, not absolute and positive data, but really individual hypotheses.

Contrary to the ideas of Munk, Uffelmann, and Ewald (who fear the use of food containing lactic acid), de Mattos has found that chronic enteritis and gastric complaints soon improve when an exclusive buttermilk feeding is resorted to. Hayem and Lesage regard lactic acid as entirely innocuous for nurslings. According to the above-named investigators, lactic acid is not toxic for infants. They gave experimentally 15 to 20 grains in divided doses, mixed with sugar, without seeing any detrimental results. Jaworski[2] found no trace of lactic acid in an infant's stomach one hour after administering it.

Riel maintains that lactic acid improves digestion, while Duclaux[3] states that lactic acid is a valuable astringent. Heubner[4] found lactic acid in the stomach of two healthy infants (to the extent of 0.16 to 0.2 per cent.). Marfan (quoting Zotow) maintains that, when lactic acid is found in the stomach of infants, it is always a pathological factor.

Buttermilk in its crude (raw) state is certainly antagonistic to other micro-organisms. This is due to the presence of lactic acid bacilli. Raw cows' milk possesses bactericidal properties, but buttermilk is much more bactericidal. The latter, sterilized with the aid of steam, showed virulent typhoid bacilli nine days after being inoculated with the same. *In non-sterilized buttermilk (raw state) virulent typhoid bacilli lost their virulence after two days, and when put into the brooding oven lost their virulence after twenty-four hours.* The bacillus lacticus of Pasteur and Hueppe seems to be identical with the bacillus lactis aërogenes of Escherich,[5] which is found in the upper part of the small intestine.

Jaworski found that pepsin is more readily secreted when lactic acid is given internally. De Mattos states that he has never met with a case of Barlow's disease among infants fed with buttermilk.

Disagreeable symptoms are frequently encountered for the first few weeks while giving buttermilk. Such are frequent vomiting and diarrhœa. These are not contra-indications for feeding, and, *notwithstanding the presence of the above-named symptoms,* the feeding should be continued. If, however, the symptoms are very severe, then the administration of astringents—such as bismuth, argent. nitrate, tannalbin, or ichthalbin—may be required for temporary relief.

An important point is that in this form of infant-feeding the large, thick, cheesy curds so commonly met with in dyspepsia and diarrhœas in feeding with cows' milk are never seen. Children thus fed seem to withstand the infectious diseases very well. A point worth noting is that when a child is more accustomed to buttermilk feeding the change to sweet milk will cause diarrhœa.

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[1] Nederlandsch Tydschrift voor Geneeskundigebladen, 1899, i, S. 945.

[2] Deutsches Archiv für klinische Medicin, Bd. xxxvii, i.

[3] "Maladies de l'Enfance," tome ii, p. 606.

[4] "Jahrbuch für Kinderheilkunde," 1891.

[5] "Die Darmbacterien des Sauglings," Stuttgart, 1886.

When we find that the weight is not increased and we desire to change to sweet milk, the latter should be gradually added to the buttermilk instead of making a distinct change suddenly.

Quality of the Buttermilk.—This is the most important part of our subject. In securing our food we must be sure that we are dealing with honest dairymen whose sole object is to deliver what is demanded for weak infants. Stale combinations made by the use of left-over centrifugal milk or skim-milk or spoiled milk which cannot be used otherwise should be inquired into and rejected.

Good buttermilk can be made from either whole milk or from cream. In Holland buttermilk is made by pasteurizing cream in Timpe's apparatus and then inoculating and buttering the same with a pure culture of lactic-acid bacillus. In order that raw milk will yield buttermilk a certain percentage of acidity must be present.

The usual precautions in milking (so-called modern stab'e hygiene) must be observed in securing milk to be used in making buttermilk. The milk should be received in sterile vessels and rapidly cooled, and should then be kept in cool cellars or ice-coolers having a low temperature (no higher than 15° or 20° C.) for eighteen to twenty-four hours. It is necessary to stir the milk occasionally. Rapidity of souring can be assisted by adding sour milk or by inoculating with a pure culture of lactic-acid bacilli. No definite rule can be laid down as to when buttering takes place; empiric methods must decide this matter. This is due to the size of the vessel used and the influence of seasonal changes, and also the amount of churning it had received. Cows' milk which contains colostrum or which is bitter is not adapted for buttering.

Butter should form in small, pin-head-sized particles in thirty to forty-five minutes. It is regarded as a mistake to have large particles of the size of a pea or larger, and dairymen look upon such buttermilk with suspicion. Buttermilk in general contains about 0.3 to 0.4 per cent. of fat.

Escherich states that the fermentation of milk is due to the splitting up of the milk sugar whereby lactic acid, O, and CO_2 are formed in the intestine.

Table No. 36, on following page, is instructive in showing the percentage of acidity present and also the difference in fat.

TABLE No. 36.

	Specific Gravity.	Solids, Percentage.	Fat.	Acidity According to Soxhlet-Henkel.
Sour milk before buttering	1.029	11.40	2.8	18.1
Buttermilk	1.029	9.60	0.5	16.1

There is, therefore, a difference of 2 per cent. in the amount of acidity present in favor of buttermilk.

An important point is to overcome the lumps usually found as coarse coagula in buttermilk. De Mattos advises adding flour—either rice, wheat, or lentil—or even some proprietary infant foods, according to the requirements of the infant.

This is merely given to hold the flocculi in finer form and to prevent their coagulation into lumps. Dyspeptic children with subnormal digestive powers should receive a minimal quantity; thus, an even tablespoonful, amounting to about 10 grams, will suffice.

Addition of Sugar.—The quantity of sugar to be added must be reckoned empirically; thus, 3 tablespoonfuls, about 90 grams, are required to each liter (quart) of buttermilk. Rarely do we need more than 100 grams.

Cane sugar or beet sugar serves best for sweetening. Sugar cannot be found in the urine nor in the fæces of infants fed on buttermilk to which sugar was added.

The results which might be expected from using cane sugar—such as diarrhœa, fermentation, sour eructations—are *totally absent* in using buttermilk feeding.

Stools.—The average buttermilk-fed infant has no more than one or two stools daily. They are *more or less solid* in consistency and *have an alkaline reaction.* It would be incorrect to state that all children fed with buttermilk *must* have yellow stools. We know that even Uffelmann, in his studies of infant-stools, states that breast-fed infants *show great variations from apparent normal stools and still thrive.* We also know that bottle-fed infants reared on cows' milk *have no definite kind of stool* which we could call a *standard* stool. Still, the buttermilk fed infant never has the coarse casein particles in the fæces that we see very frequently in the stools of infants fed on cows' milk.

The bacteriological examination of the fæces made by inoculating gelatine plates with diluted fæces showed:—

1. Liquefying colonies rendered Loeffler's nutrient gelatine strongly alkaline. Inoculated into bouillon, the latter remained clear, forming a skim on the surface. Milk was not coagulated by these micro-organisms.

They formed spores, generated H_2S, and can therefore be identified as the bacillus butyricus of Hueppe.

2. Non-liquefying colonies were inoculated into milk sugar bouillon and left in the brooding oven over eight hours at 37° C. All tubes so treated were turbid on standing over night; this fact excludes the possibility of its being the bacterium coli.

Other properties were found, such as: fermentation in milk sugar bouillon, no skim forming on the bouillon; indol does not form in peptone solution (bacterium coli would form indol); milk turns sour but slowly; no NH_3 formation.

From a study of the above properties we conclude:—

1. Bacterium coli commune must be excluded.

2. Bacterium coli lactici (Hueppe) (resp. bacterium lactis aërogenes, Escherich), must be identified.

The lactic acid bacillus, found in boiled as well as raw buttermilk, loses its potency in the intestinal canal in the presence of the bacillus butyricus, (Hueppe). The latter germ grows in overwhelming numbers and renders the intestinal contents rapidly alkaline.

An interesting point is that, if the buttermilk were originally very sour, the fæces will be very alkaline, showing how weak the bacterium acidi lactici is.

Feeding.—The writer has seen excellent results from buttermilk feeding in atrophic and marasmic children. As an article of diet during convalescence after pneumonia and typhoid fever the results were encouraging.

Quantity to be Fed.—Buttermilk as above prepared should be fed exactly as would other milk. Four ounces, increased to 5 or 6 ounces, can be fed every 3 hours, or the interval may be prolonged to 3 1/2 or 4 hours. It will be necessary to coax the child in the beginning with this new form of feeding, owing to the difference in the taste of fresh milk and buttermilk.

LAHMANN'S VEGETABLE MILK.

In Europe, and recently also in our country, the feeding of infants has been enriched with a new product; thus, Dr. Lahmann believes that the great panacea is feeding infants with milk which he designates as "vegetable milk." It resembles a thick jelly, and is made by Hewwel & Veithen, of Cologne. His theory consists, in brief, in substituting nuts and almonds, which are rich in albumin and fat, instead of cereals to dilute milk, his idea being that an emulsion, which is digestible and supposed to be rich in albumin, is doubtless better than pure water or a thin starch paste. In order to add food salts, which are not supplied by this means, he extracted them from leaf vegetables, which are rich in food salts, and added some sugar syrup. In this manner he claims to have made a preparation which he states is chemically equal to human milk, and full of nutritive value. His idea is that the interposition of plant-albumin (conglutin) particles, which coagulate with difficulty between the coagulating casein masses, would increase their digestibility by breaking them up, and that the digestion of the plant albumin and oil, as well as of the sugar and food salts, would present no difficulty.

Stutzer, of the University of Bonn, reports thus: The vegetable milk is distinguished from children's food by the absence of starchy substances. In common with Biedert's cream mixture, the vegetable milk contains considerable quantities of fat in an emulsified condition. It differs from the cream mixture in the way it is prepared, and in its other qualities.

CHEMICAL ANALYSIS.

Fat	34.72 per cent.
Plant-casein and similar nitrogenous constituents	12.00 per cent.
Sugar and plant-dextrin	31.02 per cent.
Salts	1.64 per cent.
Water	20.62 per cent.

My own personal experience has been rather favorable with the use of the vegetable milk, inasmuch as an emulsion of almonds and nuts was used to dilute the curd of cows' milk. Thus, equal parts of vegetable milk with cows' milk were taken by an infant for several months, and it was very well assimilated. Not only did the child gain in weight, but the bowels were in a fair condition, and the infant remained strong. My experience, however, is too limited to give a positive opinion.

GAERTNER MOTHER MILK.

Several years ago I was persuaded to use Gaertner milk in a series of cases. The milk was sold in tin cans. The manufacturers would not take the advice given them, *to use fresh milk and deliver the milk in clean bottles daily*. Such food as "milk sealed in tin cans" cannot be recommended for healthy and certainly not for sick infants.

In the *Medical Record*, December 11, 1897, I published a paper entitled "The Clinical Value and Chemical Results of Gaertner Mother Milk."[1] This food has now been used several years in Europe, and is the outcome of the scientific endeavors of Professor Gaertner, of the University of Vienna. The first paper was published by Gaertner in the *Therapeutische Wochenschrift*, May 5, 1895.

A few months before, January, 1895, Gaertner, in an address before the Vienna Scientific Society, explained the mode of preparation and the results obtained with his new modification of cows' milk, for such the mother milk of Gaertner really is. Professor Gaertner, in the preparation of his food, has aimed to overcome what has been the great difficulty in infant-feeding—namely: to reduce the excess of casein by a scientific process without the addition of chemicals.

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[1] Those interested are referred to my paper, entitled "Gaertner Milk," containing an elaborate chemical report by Professor Poole. New York Medical Record, December 11, 1897.

To achieve this result he employs a machine called a separator or Pfannhaüser centrifuge, which makes 4000 or 8000 revolutions per minute. The apparatus consists essentially of a drum of steel, which revolves on its axis. This drum is filled with equal parts of fresh cows' milk and sterilized water. The mixture contains approximately the same amount of casein as human milk, for cows' milk undiluted contains about twice as much casein as human milk. The mixture is next poured into the centrifuge and the speed of the drum is carefully regulated, so as to separate the mixture contained therein into (1) a creamy (fatty) milk and (2) a skimmed milk. The two portions so separated are then led off separately by suitable openings in the centrifuge.

The analysis of each of these portions shows that the creamy milk has the same quantity of fat as is found in human milk, while about 2 per cent. of the casein is contained in the skim milk, and the remainder, about 1.7 per cent., remains in the creamy milk. The chemical composition of fat milk is shown in the following table:—

TABLE NO. 37.

	Proteid.	*Fat.*	*Sugar.*	*Ash.*
Fat milk	1.76	3·3.5	2.5	0.35
Human milk	1.03	3.5	7.03	0.21
Cows' milk, diluted with one-half water	1.76	1.6	2.5	0.35

If, now, 3 or 4 grams of milk sugar be added to every 100 cubic centimeters of fat milk, the percentage of sugar is brought up to the level of sugar in human milk. This addition is made before sterilizing. The fat milk has the advantage over the diluted milk of having "a higher percentage of fat;" it also curdles more slowly than diluted milk and the curd forms a more flocculent precipitate.

Baginsky[1] mentions Gaertner milk as a new form of food introduced. In our country Jacobi[2] states that Gaertner milk is applicable to the majority of infants who require cows' milk appropriately prepared. A few years ago I subjected the milk to a very rigid test from June to October, the worst months for milk digestion. The hygienic conditions of the infants were those found in the average tenement house, too well known to need description.

The guides for ascertaining the degree of assimilation were the following factors:—

1. The child's general condition, as manifested by its appearance, appetite, and sleep.

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[1] "Lehrbuch der Kinderkrankheiten," fifth edition, pages 35 and 36.

[2] "Therapeutics of Infancy and Childhood," page 508.

2. The presence or absence of gastro-enteric disturbances, such as vomiting, colic, restlessness.

3. The condition of the stools, constipation or diarrhœa, the number of stools in twenty-four hours.

4. The gain in weight; weekly observations.

The nurses or mothers were instructed to note the amount of food taken and the number of stools in twenty-four hours.

We submitted the stools passed in twenty-four hours to Mr. Herman Poole, our chemist, whose chemical report[1] is of interest. We tried to ascertain how much proteids, fat, sugar, and salts were taken, how much absorbed, and how much was voided in the fæces after having taken part in metabolism.

BACKHAUS'S MILK.

The following method is employed in the production of this food. The milk from different breeds of cows is mixed and passed through a centrifuge, to separate the cream from the milk and to remove any impurities that might have gained access to the milk, notwithstanding the great care used in handling. Three grades are produced: two for infants, the third representing full milk in its composition. After separating it from the cream the milk is exposed to the action of a mixture of rennet, trypsin, and sodium carbonate, which are combined in such proportions that the trypsin will have converted at the end of thirty minutes 30 per cent. of the casein into soluble albumin. By this time the action of the rennet coagulates the balance of the casein and thus arrests the action of the trypsin. The temperature of the mixture is now raised to 80° C. (176° F.) by the introduction of steam into it. At this temperature it is kept for five minutes. At the end of this time it is strained through cloths and mixed with half its volume of water, one-fourth its volume of cream, and the necessary amount of sugar of milk. It is finally put up in bottles holding 125 grams (about 4 ounces) and sterilized.

The second grade, for older children, is obtained by mixing equal parts of milk and water with half the quantity of cream and with milk sugar. This is put up in quantities of 200 grams (about 6 $^1/_2$ ounces).

The third grade, in bottles holding 300 grams (about 10 ounces), represents cows' milk in composition, modified by the above-mentioned process. The composition of the three grades is given as follows:—

Fat	3.1	3.2	3.3
Sugar of milk	6.0	5.4	4.8
Casein	0.6	1.8	3.0
Albumin	1.0	0.3	0.5
Ash	0.4	0.4	0.7

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[1] New York Medical Record December 11, 1897.

The milk has been tried at the Wiener allgemeine Poliklinik by Frühwald in a series of twenty cases, the histories of which are given by the author. With the exception of six, these children have been under observation for more than two months. When first seen the children were all suffering from different forms of digestive disturbances, and from malnutrition; some were suffering from severe marasmus, and most of them passed through some other disease while they were under observation. Three of the infants took the breast in addition to the Backhaus milk for periods of two and three weeks, when they, too, had to be put on the artificial milk entirely. The children took about six bottles of No. 1 up to four weeks, seven to eight to the end of the second month. From the middle of the third month the second grade was gradually substituted, while No. 3 was used only in the case of an older child. A daily gain was observed of from 18 to 30 grams (about $^1/_2$ to 1 ounce). In private practice and in healthy children a gain of 50 grams (about $1\,^1/_2$ ounces) not rarely happens. The milk keeps well.

CONDENSED MILK OR CONDENSED CREAM.

Hundreds of infants are fed with condensed milk. This has its reasons:—

1. The readiness with which condensed milk is obtained.
2. The great cheapness of this article.
3. The ease with which the feeding mixture can be prepared.

Jacobi says that some manufacturers use pure cows' milk; others find it in accordance with the health of their bank accounts to use skimmed milk.

Quantity of Sugar in Condensed Milk.—Milk sold in our city for immediate use contains about 12 to 15 per cent. of sugar. Milk to be kept for an indefinite time contains as much as 50 per cent. of sugar. These variations show how serious it is to *use the same quantity* of condensed milk *all the time* and from different sources with such an *enormous variation in the quantity* of sugar.

Kehrer—quoted by Jacobi—states, regarding it, that it increases the formation of lactic acid. Fleischman states that it gives rise to thrush and diarrhœa; Daly, that it fattens them (?), but gives rise to rachitis.

The worst specimens of rachitis and spinal rickets seen in my clinic are in condensed-milk babies. Our medical literature reports many cases of apparent health in infants fed on condensed milk. It has led Dessau, with a large experience with infants, to mention such a method, although he advocates cows' milk, properly modified, for continued use.[1]

In traveling, when good fresh cows' milk cannot be obtained, then I permit the use of condensed milk, but for a few days or for a week only, as on the ocean steamer, where cows' milk cannot be had.

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[1] See my paper on infant-feeding (read before the Society for Medical Progress, April 11, 1896), published *in extenso* in Pediatrics for July 15, 1896.

My experience among thousands of children seen in my Children's Service at the German Poliklinik and also at the service at the West-Side German Dispensary during these last fifteen years has been that children so fed have rickets; that they are predisposed to the infectious disorders; that they have less resistance and far less vitality, especially in combating such diseases as pneumonia or diphtheria; that they have tendencies to hernias and deformities, owing to the softer condition of their muscles and bones; that they invariably suffer with constipation, alternating with diarrhœa; that their dentition is delayed, compared with other methods of hand feeding. Thus summing it up, I cannot approve of this method at all.

Condensed cream will be lauded by the mother whose baby is well, and again the same food will be condemned by the mother of an infant whose rickety head, bones, and muscles are founded on an impoverished diet of condensed milk. We can account for the rickety child, but we cannot account for the healthy one on the same food.

The directions on the tin of the Anglo-Swiss Condensed Milk Company's Milkmaid Brand of condensed milk are, for new-born infants, add 14 parts of water; as the child grows older, gradually use less water, but never less than 7 parts.

The analyses of all these condensed milks are of the milk diluted with with 7 parts and 14 parts of water—the two extremes.

The following brands of condensed milks are considered to be among the best upon the market.

TABLE NO. 38.

	Milkmaid Brand.		*Gail-Borden Eagle Brand.*		*Nestlé's Swiss Milk.*		*Woman's Milk.*
	With 7 Parts Water.	With 14 Parts Water.	With 7 Parts Water.	With 14 Parts Water.	With 7 Parts Water.	With 14 Parts Water.	
Water . . .	88.18	93.59	89.10	94.09	87.95	93.46	88.51
Ash . .	0.36	0.19	0.29	0.16	0.25	0.14	0.34
Proteids . .	1.50	0.82	1.31	0.71	1.51	0.82	2.35
Fat	1.70	0.92	1.18	0.64	2.14	1.16	2.41
Cane-sugar .	6.00	3.25	6.59	3.57	5.81	3.15	
Milk-sugar .	2.26	1.23	1.53	0.83	2.34	1.27	6.39

On studying the clinical relationship of the component parts of condensed milk, it is very apparent that diluting the Eagle brand of condensed milk with 14 parts of water, we have but 0.7 per cent. of proteid, 0.6 per cent. of fat, and 3.5 of sugar. The deficient bone-building and muscle-forming ingredients accounts for the rachitis which invariably results.

CHAPTER VI.

PROPRIETARY INFANT FOODS.

PATENT FOODS.

THERE are a great many infant foods in use at the present time. No one will question the large amount of foods sold. This is due to several reasons: First, because the laity have been educated to use them, when cows' milk or even when breast-milk, in rare instances, disagrees; second, physicians of large experience advocate the use of a great many patent foods. When disturbances in the stomach or intestines interfere with the proper digestion and assimilation of the proteids, then frequently the modification of the milk, by the addition of these foods, yields good results. In some instances where there is no appetite we frequently can stimulate an appetite by advocating the temporary use of these foods.

In the large cities where breast-milk is unobtainable for infants, these foods are frequently given.

During the course of summer complaint, typhoid fever, or acute infectious diseases, I have frequently advised the use of diluted milk with several teaspoonfuls of a nutritious food, rich in barley malt. The objectionable features of patent foods consist in the ease with which they are procured, and the careless manner in which they are given. Thus, a large portion of the laity will follow the directions on the label of the box of patent food to the detriment of the child. Many a case of rickets or scurvy can be traced to ignorance in giving patent foods. We know, however, that *there are some virtues in these patent foods,* and to attribute all cases of rickets or scurvy to this one cause is wrong. Investigations made by the American Pediatric Society showed that a large number of children fed on sterilized milk suffered with scurvy. A great many facts must therefore be considered before condemning or praising one or all of the foods. The intelligent physician knows that raw milk or milk warmed to blood heat possesses anti-scorbutic properties. When a given commercial food is added to raw milk, thoroughly mixed, and heated to blood heat or to a pasteurizing temperature, we still retain the virtues of the milk and increase its nutritive value with the aid of the food selected. Roughly speaking, there are two kinds of infant foods on the market: *(a)* Infant foods to be used as adjuncts to fresh cows' milk. *(b)* Infant foods in which desiccated cows' milk is a constituent.

These foods are commonly known as dried-milk foods, although in this class of foods milk solids constitute but from one-eighth to one-fourth the substance of the foods, the balance consisting of matters derived from cereals. In some of these foods the starch of the cereals is untransformed, and they may be termed farinaceous dried milk foods. In others the starch of the cereals has been transformed into dextrin and maltose, and they may be termed malted dried milk foods.

All attempts to preserve whole cows' milk by evaporating it to dryness have been failures; the fat of desiccated milk soon acquires a rancid flavor, and the caseous matter does not properly dissolve in water, as the drying process destroys its colloidal condition. In the dried milk foods the caseous matter of the cows' milk is intimately mixed with the other ingredients, but its colloidal condition has been destroyed, and it is in the form of fine, hard, granular particles, very sparingly soluble in water.

The group of infant foods used as adjuncts to cows' milk are either farinaceous foods, made from cereals and consisting largely of unconverted starch; or malted foods, also made from cereals, but having the starch transformed into soluble maltose and dextrin. As fresh cows' milk is, without doubt, the best generally available material for the artificial feeding of infants, the foods of the latter class, used for the modification of fresh cows' milk, are more in accord with physiological principles than are the dried milk foods.

Of the large number of infant foods that have been put on the market, it is our purpose to describe a few commonly known foods. In order to judge fairly of the nutritive value of an infant food and its resemblance to woman's milk, it is necessary to know its composition after its preparation for the nursing-bottle according to the directions of its manufacturer, and the analyses that accompany the following descriptions are of the foods prepared for use for infants six months of age as per directions on the packages.

LIST OF INFANT FOODS.

The following list of infant foods is quite complete, although there are but four or five foods that are used in any quantity; the balance having a small demand.

Blair's Wheat Food (cereal food; baked wheat).

Hubbel's Wheat (cereal food; baked wheat).

Wampole's Milk Food (composed of predigested cereals, beef and milk).

Wyeth's Prepared Food (composed of malt milk and cereals).

Just's Food (partially predigested cereals. To be used with milk).

Malted Milk (malted and containing dried milk).

Horlick's Food (predigested, to be added to milk).

Mellin's Food (predigested, to be added to milk).

Imperial Granum (baked wheat).

Nestlé's Food (composed of cereals partially predigested and dried milk).

Lacto-Preparata (dried milk).

Lactated Food (farinaceous with milk sugar).

Ridge's Food (farinaceous).

Peptogenic Milk Powder (to modify milk).

Pegnin (also used to modify the casein of cows' milk).

Zimmerman Barley Oat Food (cereal).

Nutrico Food (cereal).

Lange's Tissue Food (a condensed milk).

Hayes's Oat Food (cereal).

Allenbury's Milk Food, No. 1 (predigested; prepared with water, contains dried milk).

Allenbury's Milk Food, No. 2 (predigested; prepared with water, contains dried milk).

Allenbury's Malted Food, No. 3 (partially predigested; prepared with milk).

Benger's Imported (cereal and not predigested).

Neave's Food, Imported (farinaceous).

Eskay's Albuminized Food.

Cereal Milk.

Carnrick's Soluble Food.

Diastased Farina.

Coombs's Malted Food.

Robinson's Groats.

Robinson's Patent Barley.

Chapman's Whole Flour.

Scott's Oat Flour.

Milkine.

The published analyses of woman's milk show the great variability of its composition, especially as regards the percentage of proteids and fats. The analysis of woman's milk used in the following tables is by Dr. Luff, adopted as the standard by Cheadle. It agrees closely with Leed's analysis, excepting as to the fat, which is given by Luff as 2.41 per cent. and by Leeds as 4.13 per cent.; the latter amount seems too large, as it exceeds considerably the published averages of a number of observers.

NESTLÉ'S FOOD.

Nestlé's food is a farinaceous dried milk food. According to the manufacturers, it is made "from the richest and purest cows' milk, the crust of wheaten bread, and cane sugar," and is a "form of modified milk." "No cows' milk is to be added to Nestlé's food; nothing but water, and that water is boiled."

Upon examination, unconverted starch and cane sugar are found to be its principal constituents, amounting to about 70 per cent. of the whole. The directions for preparing Nestlé's food for the nursing bottle, for infants six months old, are to use 2 level tablespoonfuls of the food to $^1/_2$

pint of water; mix the food with enough warm water to make a smooth paste that will pour, add the rest of the water and boil in a saucepan, stirring constantly until it thickens and a milky foam appears on the top.

TABLE No. 39.

	Composition of Nestlé's Food,[1] *when Prepared as Above.*	*Woman's Milk.*
Water	92.76	88.51
Salts	0.13	0.34
Proteids	0.81	2.35
Fat	0.36	2.41
Starch	1.99	
Cane-sugar	2.57	
Maltose, dextrin, etc.	0.44	
Milk-sugar	0.84	6.39
	Reaction alkaline.	Reaction alkaline.

The mixture owes its thick condition mainly to the insoluble starch present. The total carbohydrates therein (5.84 per cent.) are somewhat less than the carbohydrate, milk sugar (6.39 per cent.), in woman's milk; it is to be noted that of this amount 1.99 per cent., or about one-third, consists of insoluble starch.

The fat is nearly one-sixth and the proteids are about one-third of the amounts in woman's milk, and over one-half of the proteids is insoluble, owing to the colloidal condition of the milk-casein having been destroyed by drying during manufacture.

HORLICK'S MALTED MILK.

This is a malted dried milk food, stated on the circulars to be composed of pure, rich cows' milk combined with an extract of malted grain, and not to require the addition of cows' milk. Its makers claim that, by special treatment with their new agent, plant pepsin, the casein, or cheesy part, of the cows' milk is kept from forming large and irritating curds in the stomach.

The directions for preparing the food for an infant six to twelve months of age are to dissolve 4 to 6 teaspoonfuls in $^{1}/_{2}$ pint of water. Composition when prepared by using 4 teaspoonfuls of food to $^{1}/_{2}$ pint of water:—

TABLE No. 40.

	Horlick's Milk.	*Woman's Milk.*
Water	90.74	86.73
Total solids	9.26	13.26
Fats	0.63	4.13
Proteids	1.65	2.00
Inorganic salts	0.36	0.20
Carbohydrates	6.62	6.93

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[1] According to Chittenden.

This food is very nearly soluble in water, as its principal constituents are the soluble carbohydrates—maltose, dextrin, and milk sugar. The drying process has destroyed the colloidal condition of the caseous matter of the milk, and it is in the form of finely powdered, hard particles, sparingly soluble in water.

The proteids, fat, and carbohydrates are all less than in woman's milk, the proteids being not quite four-fifths, and the fat not quite one-seventh of the amounts in woman's milk. The amount of milk employed must be very small in proportion to the cereal constituents, since the mixture, prepared as above, corresponds to a dilution of 1 part of good cows' milk with about 4 parts of water.

MILKINE.

This is a malted dried milk food. Its makers state it is a complete food ready for immediate use by the addition of water, and the only prepared food that combines the nutritive elements of meat, milk, and cereals.

In this malted dried milk food, beef extract is combined with cereal extractives and dried milk. Soluble carbohydrates are its principal constituents, forming nearly three-fourths of the product. The proteids are sparingly soluble.

The directions for preparing milkine for an infant three to six months of age are to dissolve 1 to 2 dessertspoonfuls of food in a breakfastcupful of water.

Composition when prepared with 2 dessertspoonfuls in a breakfastcupful of water:—

TABLE No. 41.

	Milkine.	*Woman's Milk.*
Water	92.78	88.51
Salts	0.23	0.34
Proteids	0.92	2.35
Fat	0.43	2.41
Maltose, dextrin, etc.	4.74	
Milk-sugar	0.90	6.39
	Reaction alkaline.	Reaction alkaline.

The total solids are hardly two-thirds of the amount in woman's milk. The fat especially is greatly deficient, being only about one-sixth of the amount in woman's milk, and the proteids are but two-fifths of the amount in woman's milk.

A dilution of 1 part of good cows' milk with about 7 parts of water will contain about the same amount of milk as milkine prepared as above.

CEREAL MILK.

Cereal milk is a malted dried milk food. It is stated by its makers to be a complete food, cooked and ready for use with the simple addition of water, and to be made from the purest Vermont dairy milk, the finest wheat gluten flour, the best barley malt, and milk sugar.

Cereal milk in general appearance very much resembles the other malted dried milk foods, but it contains a much greater percentage of milk sugar, showing that this substance is used in its manufacture, as claimed.

The directions for preparing it for use are to mix 1 teaspoonful of cereal milk in a teacupful of hot water for infants under three months of age or for a very delicate child.

Preparation for a child six months old:--

"To make 6 ounces Prepared Food, use 3 1/2 rounding teaspoonfuls Cereal Milk Powder," as directed.

Composition when prepared:—

TABLE No. 42.

	Cereal Milk.	*Woman's Milk.*
Water	90.98	86.73
Total solids	9.02	13.26
Fats	0.38	4.13
Proteids	1.09	2.00
Inorganic salts	0.21	0.20
Carbohydrates	7.34	6.93

The reaction to litmus was neutral, or faintly acid. The food contains starch. No white of egg or cream was added, since neither *is definitely* prescribed. This fact may be taken into consideration when comparing the analysis with that of the other foods.

The total of soluble carbohydrates as above is practically the same as in woman's milk; the amount of proteids is less than one-half the amount in woman's milk, and about one-half is insoluble in water. The amount of fat is one-eleventh the amount in woman's milk. The small amount of fat indicates that the cereal extractives and milk sugar make up the bulk of the solids of this food, and that a dilution of 1 part of good cows' milk with 11 parts of water would be the counterpart of the above mixture as to the amount of milk therein.

WAMPOLE'S MILK FOOD.

Wampole's milk food is a malted dried milk food. Its makers state that it is made from malted cereals, beef, and milk, and when mixed with warm water it is immediately ready for use; no other preparation necessary.

This dried milk food is very nearly soluble in water, owing to the soluble carbohydrates being so large a constituent. A little less than one-half of the proteids is insoluble in water. A small amount of beef extract has been combined with the cereal extractives and dried milk.

To prepare it for an infant six months to 1 year of age, the directions are to dissolve 4 to 6 teaspoonfuls of the food in 6 ounces of hot water. Composition when prepared by dissolving 6 teaspoonfuls in 6 ounces of water:—

TABLE No. 43.

	Wampole's Milk-food.	*Woman's Milk.*
Water	88.59	88.51
Salts	0.46	0.34
Proteids	1.58	2.35
Fat	0.73	2.41
Maltose, dextrin, etc.	7.65	
Milk-sugar	0.99	6.39
	Reaction alkaline.	Reaction alkaline.

Compared with woman's milk it is seen that the carbohydrates are considerably in excess, and the proteids and fat are deficient, the fat especially, it being less than one-third the amount in woman's milk.

One part of good cows' milk diluted with about 3 1/2 parts of water would be analogous to the dilution of milk in Wampole's milk food prepared as above.

IMPERIAL GRANUM.

Imperial granum is a farinaceous food to be used as an adjunct to cows' milk.

Its makers state that it is a solid extract derived from very superior growths of wheat, nothing more. It appears to be made as claimed from wheaten flour and to be mainly composed of torrefied starch.

For an infant six months of age it is to be prepared by cooking 3 1/2 teaspoonfuls of food in 21 ounces of water and 20 ounces of milk.

Composition when prepared as above:—

TABLE No. 44.

	Imperial Granum.[1]	*Woman's Milk.*
Water	91.53	88.51
Salts	0.34	0.34
Proteids	2.15	2.35
Fat	1.54	2.41
Starch	1.22	
Maltose, dextrin, etc.	0.58	
Milk-sugar	2.71	6.39
	Reaction alkaline.	Reaction alkaline.

The total of solids contained is one-quarter less than in woman's milk; the carbohydrates are nearly one-third less than the amount in woman's milk and it should be observed that 1.22 per cent., or about one-fourth of them, consist of starch; there is only a slight deficiency in the amount of proteids, but a considerable deficiency in the amount of fat. By using more milk or milk and cream and less water than above employed the percentages of fat, proteids, and soluble carbohydrates would be increased.

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[1] According to Chittenden.

Its very large proportion of starch forms the principal objection to this food.

The presence of unconverted starch causes the thick condition of the mixture.

ESKAY'S ALBUMENIZED FOOD.[1]

This food is to be prepared with cows' milk. Its makers state, in recommending their product, that it contains the more easily digested cereals, combined with egg albumin.

Eskay's albumenized food consists largely (about 88 per cent.) of carbohydrates; the soluble carbohydrates, mostly milk sugar, are about 50 per cent., and the insoluble carbohydrates, mostly starch, are a little less than 40 per cent. On account of this proportion of starchy matter in the dry food, it may be termed farinaceous. The makers, however, claim that in the process of manufacture the starch granules are almost entirely disintegrated, and when the food is prepared with milk according to directions the percentage is said to be not over 1 $^1/_2$ to 2 per cent. An analysis of the dry food shows that it contains about 9 per cent. of proteid matter, but when prepared according to the six months' formula it analyzes about 2.55 per cent.

The fats as well as the proteids are almost entirely vegetable, with a small percentage of each derived from eggs. Excepting the egg, fat, and albumin, the preparation is produced from wheat, oats, and barley, and while no proteolytic ferments are used in its manufacture, the insoluble carbohydrates are nevertheless partially converted into dextrin by a special process of heating, which ruptures the starch granules and converts a small amount of the starch.

The egg albumin is said to be first combined with sugar of milk in such a thorough manner that the particles are finely subdivided, and no firm, hard coagulum can therefore take place in the stomach. The particles retain their identity, and do not coalesce; so that in the finished preparation the egg albumin is suspended throughout the whole mixture in very fine particles, which are easily digested, because the gastric juice acts by contact, and, the smaller the particles, the greater the effect of the gastric juice. No claims are made by the manufacturers for its solubility, but for its ease of digestion and its nutritive value.

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[1] The chemical analyses of Eskay's food, Mellin's food, cereal milk, and malted milk here given were specially made for me by Professor Lafayette B. Mendel, at the Sheffield Laboratory of Physiological Chemistry, Yale University.

The directions for preparing it for an infant six months of age are to take:—

Eskay's food	5 tablespoonfuls
Hot water	1 pint
Rich cows' milk	2 pints

As directed.

Composition when prepared as above:—

TABLE NO. 45.

	Eskay's Food.	*Woman's Milk.*
Water	84.46	86.73
Total solids	15.54	13.26
Fats	3.07	4.13
Proteids	2.78	2.00
Inorganic salts	0.58	0.20
Carbohydrates	9.11	6.93

The reaction to litmus was amphoteric.

The food contains a noticeable quantity of starch which is in the form of a thin paste in which all the grains are ruptured by the process of preparation. The boiling was carried on for fifteen minutes in the sample analyzed.

Rich milk (4.85 per cent. of fat) was used as specifically directed.

MELLIN'S FOOD.

Mellin's food is a malted cereal. This food is stated by its makers to be a soluble dry extract from wheat and malt, for the modification of fresh cows' milk.

The carbohydrates therein are in the form of dextrin and maltose, and constitute about 80 per cent. of the food; the proteids amount to about 10 per cent. and are derived from the cereals. Mellin's food is almost completely soluble in water. It is especially noticeable that this food does not contain any starch.

The directions for preparing this food for use for infants six months of age and over are to dissolve 2 heaping tablespoonfuls of food in $^1/_4$ pint of hot water and $^3/_4$ pint of cows' milk.

Composition when prepared as above:—

TABLE NO. 46.

	Mellin's Food.	*Woman's Milk.*
Water	85.37	86.73
Total solids	14.63	13.26
Fats	3.16	4.13
Proteids	3.03	2.00
Inorganic salts	0.70	0.20
Carbohydrates	7.74	6.93

The reaction to litmus was amphoteric. The food gave no reaction for starch. Milk having 4.25 per cent. of fat was used in this preparation.

In total solids this food differs but slightly from woman's milk, and in the various constituents its similitude to woman's milk is remarkably close. Of the carbohydrates the maltose and dextrin are a little less in amount than the milk sugar, and the total carbohydrates (7.74 per cent.) are greater than the amount in woman's milk.

The manufacturers of Mellin's food present many formulas for preparing the food for use to meet various indications. The following formulas are given with the analyses of the respective milk modifications:—

TABLE NO. 47.

FORMULÆ AND ANALYSES FOR PREPARING MELLIN'S FOOD.

For Infants About Two Months Old.

Mellin's food, 6 teaspoonfuls (level). Milk, 6 1/2 fluidounces. Water, 9 1/2 fluidounces.	Gives this composition:	Water	93.40
		Salts	0.35
		Proteids	1.69
		Fat	1.53
		Carbohydrates (no starch)	3.03

Low Proteids.

Mellin's food, 2 tablespoonfuls (heaping). Cream, 1 1/2 tablespoonfuls. Milk, 4 fluidounces. Water, 12 fluidounces.	Gives this composition:	Water	91.50
		Salts	0.37
		Proteids	1.45
		Fat	2.50
		Carbohydrates (no starch)	4.18

High Fat and Low Proteids.

Mellin's food, 3 tablespoonfuls (heaping). Milk, 4 fluidounces. Cream, 2 tablespoonfuls. Water, 12 fluidounces.	Gives this composition:	Water	89.36
		Salts	0.45
		Proteids	1.65
		Fat	3.00
		Carbohydrates (no starch)	5.54

JUST'S FOOD.

Maltose, free	12.6 parts
Maltose, combined with dextrin as maltodextrin	15.5 parts
Dextrin, with trace soluble starch	61.3 parts
Albuminoids	1.1 parts
Fat	.1 part
Ash	.9 part
Water	5.3 parts
Cellulose	.2 part
Indeterminable (insoluble)	3.0 parts
	100.0 parts

This sample was neutral in reaction; the sample was analyzed June 14, 1895; was slightly acid, which suggests that the process of manufacture has been changed a little. The food has no diastasic action.

The small amount of albuminoids, light color of the food, and the low degree of conversion, particularly of the last sample analyzed, indicate very conclusively that no considerable quantity of malt or any entire cereal is used in its manufacture. It is not hygroscopic—it can be exposed to air for quite a long time without becoming sticky.

Upon examination, the above analysis indicates a close relation of Just's Food to commercial glucose, although it contains no dextrose.

A product similar to Just's might be obtained from the glucose process if the process were stopped early in the conversion before the starch was converted to glucose; that is, when the conversion of the starch has progressed only as far as dextrin and maltose; or it might be possible, during the process of making glucose, to draw off a portion in the earlier stages of the process, and neutralize and clarify, and obtain a product similar to Just's food.

In order to get such a percentage, as is given in the analysis of dextrin and maltose, from a starch material by the action of *malt diastase,* it would be necessary to use *so much malt* that the amount of albuminoids contained would be much larger than is shown by the analysis, and the product would have a decided malt flavor and quite a marked color, and these Just's food has not.

PEPTOGENIC MILK POWDER.

This product is stated by its makers to be an article containing milk sugar and a digestive ferment capable of acting on casein, offered for the preparation of an artificial infant food. McGill states: "It is not, in the strict sense, a food. Its professed object is so to change the composition of cows' milk as to render this comparable to human milk. This it seeks to do by introducing milk sugar and small quantities of albuminoids." According to McGill's analysis, it is composed almost entirely of milk sugar (96.60 per cent.).

The following analysis is by Leeds, and is taken from a circular of the makers.

Composition of "humanized milk" prepared as directed, using 4 measures of peptogenic milk powder with $^1/_2$ pint of milk, $^1/_2$ pint of water, and 4 tablespoonfuls of cream:—

TABLE NO. 48.

	Humanized Milk.	*Woman's Milk.*
Water	86.20	88.51
Ash	0.30	0.34
Proteids	2.00	2.35
Fat	4.50	2.41
Milk-sugar	7.00	6.39
	Reaction alkaline.	Reaction alkaline.

Chittenden's analysis of this "humanized milk" is almost identical with the above.

The proteids of the cows' milk undergo a change in the peptonizing process, being converted chiefly into partial peptones, and in this form they cannot be said to resemble the proteids of woman's milk, which have not been acted upon by a proteolytic ferment.

TABLE No. 49.—*Summary Giving Comparison of the Foods Analyzed by Professor Mendel.*

	Cereal Milk.	Malted Milk.	Mellin's Milk.	Eskay's Milk.	Human Milk.
Water	90.98	90.74	85.37	84.86	86.73
Total solids	9.02	9.26	14.63	15.54	13.26
Fats	0.38	0.63	3.16	3.07	4.13
Proteids	1.09	1.65	3.03	2.78	2.00
Inorganic salts .	0.21	0.36	0.70	0.58	0.20
Carbohydrates .	7.34	6.62	7.74	9.11	6.93
Reaction to litmus	neutral	alkaline	amphoteric	amphoteric	

(The figures indicate percentages by weight.)

The figures quoted for human milk are well-known averages; it would be more accurate to give figures indicating the healthy variations.

TABLE No. 50.

Composition of some Infant Foods as Prepared for the Nursing Bottle in Comparison with Mother's Milk. Prepared According to Directions for Infants of Six Months.[1]

	Mother's Milk.	Malted Milk.	Nestlé's Milk Food.	Imperial Granum.	Mellin's Food.	Peptogenic Milk Powder.
Special Gravity	1031	1025	1024	1025	1031	1032
Water	86.73	92.47	92.76	91.53	88.00	86.03
Total solid matter . . .	13.26	7.43	7.24	8.47	12.00	13.97
Inorganic salts . .	0.20	0.29	0.13	0.34	0.47	0.26
Total albuminoids . .	2.00	1.15	0.81	2.15	2.62	2.09
Soluble albuminoids .	2.00	1.15	0.36	1.67	2.62	2.09
Insoluble albuminoids	0	trace	0.45	0.48	0	0
Fat	4.13	0.68	0.36	1.54	2.89	4.38
Milk sugar	6.93	1.18	0.84	2.71	3.25	7.26
Cane sugar	0	0	2.57	0	0	0
Maltose	0	3.28	trace	trace	2.20	0
Dextrin	0	0.92	0.44	0.58	0.53	0
Soluble Starch	0	0			0	0
Starch	0	0	1.99	1.23	0	0
Reaction	alkaline	alkaline	alkaline	alkaline	alkaline	alkaline

[1] Copied from an article in the New York Medical Journal, July 18, 1896, by R. H. Chittenden, Ph. D.

CHAPTER VII.

CONCENTRATED PREPARATIONS OF ALBUMIN.

Among the concentrated preparations of albumin on the market are:—

Somatose.

Somatose, meat albumin, isolated artificially by chemical process. A remedy which has more the character of a pharmaceutical preparation of a stimulant tonic, rather than of a food. This is evident also in its cost. It is used extensively and with good results. It is advisable to be cautious with the same owing to the diarrhœal tendency. It should, therefore, not be given to very young infants.

Chemical analysis:—

Water	11.41 parts
Digestible albumin	41.21 parts
Peptone	27.12 parts
Other nitrogenous substances estimated by difference and assumed to consist of meat basis and extractives	14.51 parts
Ash	5.75 parts
	100.00 parts

Somatose is stated to be prepared from meat. It is a light yellow powder, odorless, nearly tasteless, and readily and completely soluble in water. The solution has a slightly alkaline reaction.

The substance is a predigested, *nitrogenous food.*

It is probably made from animal substances, but we are unable to state from what materials or by what process the article is manufactured. Its content of phosphoric acid and potassium is very much less than should be the case if it were prepared from muscular tissue, or meat in the usual sense of the term.

Eucasin.

Eucasin is an ammoniated salt of casein. A soluble preparation of casein, obtained by chemical process. It contains phosphorus, 0.8 and 13.1 per cent. of nitrogen. It is well tolerated by older children, but does not prove very satisfactory in very young infants.

Nutrol.

Nutrol is the sodium compound of casein, also soluble.

TROPON.

Tropon is a mixture of animal and vegetable albumin. Obtained chiefly from buckwheat flour by dissolving with dilute caustic soda, precipitating with acid, and purifying with hydrogen peroxide. It was introduced by Finkler (*Berlin klin. Wochen.*, 1897, Nos. 30, 33). Also sano-tropon, which is really a mixture of dextrinized barley flour with tropon. Sanatogen is very similar to the latter preparation, and consists of casein with glycero-phosphate of sodium, and 13 per cent. nitrogen.

PLASMON.

Plasmon is a preparation of casein, partly soluble. Obtained by chemical process, the use of carbonic acid and bicarbonate of soda. It is adapted for the strengthening of ordinary broths, but it must be distinctly remembered that all of these preparations are merely suggestions as "substitutes," and should never be thought of as suitable for constant feeding.

SOSON.

Soson is a new albuminous product resembling plasmon and tropon in nutritive qualities.

Other foods are *Sanose-Albumose (Schering); also Sanatogen, Eulactol, Protogen (Blum), and the Somatose Cream Mixture of the Elberfeld Farbenwerke.*

All of the above preparations have been used by the author in doses of $^1/_2$ teaspoonful added to either barley soup, chicken broth, farina, or rice gruel.

When typhoid fever and such disorders tax the ability of the attending physician, owing to the rejection of food, then, and then only, should milk or its dilution be laid aside and the above foods given a trial. Valuable service has been frequently given by such standard preparations as panopepton, liquid peptonoids, and Mosquera's beef jelly, where the gastric irritability prevents the regular administration of milk.

MOSQUERA'S BEEF MEAL.

This is a partially digested beef preparation, containing in addition to the proteids, 13.06 per cent. of fat.

The analysis is:—

Water	6.68
Salts and inorganic substances	4.20
Fats	13.06
Insoluble proteids	47.61
Albumose	29.43

Taking the insoluble proteids, albumose and fats, together, 100 grams are equal to 435 calories, while the albumose alone represents 122 calories.

MOSQUERA'S BEEF JELLY.

This beef jelly contains 12.66 per cent. of albumose and 14.35 per cent. meat extractives. It represents therefore the stimulant as well as the nutrient qualities of beef.

A two-ounce jar is equal to 34 calories from the albumose, and if we were to take the meat extractives at the same ratio, the total number of calories would be 94.

PANOPEPTON.

Panopepton represents the products of the peptic digestion of fresh, lean beef, and of the proteolytic and amylolytic digestion of whole wheat; proteids in the form of albumose and peptone, carbohydrates as achroodextrins and maltose, and the natively associated soluble, savory, and stimulant mineral constituents. These soluble food constituents are sterilized, concentrated, and, after being duly proportioned, are redissolved in sherry wine.

Panopepton contains 20 per cent. of solids as follows:—

Soluble proteids	6 per cent.
Carbohydrates	13 per cent.
Ash	1 per cent.

It will be noted that the ratio of proteids and carbohydrates is as 1 to 2.16, which is best calculated for a proper nutritive balance. Harrington's analysis shows that it yields 17.99 per cent. of solid matter (including 0.97 per cent. of mineral matter) and 18.95 per cent. by volume of alcohol.

This is undoubtedly one of the best predigested foods of the class that contains both proteids and carbohydrates in their most available forms, and, from the data supplied by its manufacturers, it is evident that it is designed upon scientific principles to represent the varied constituents of a mixed diet, and that its preparation is carried out in a most perfect manner in all respects. The wine serves both as a stimulant and preservative, and the product has an agreeable taste and flavor. One hundred grams (about 3 1/3 ounces) equal 77.5 calories.

It must not be taken for granted that because one chemist finds a very high percentage of alcohol in a standard preparation that the same amount will be found by other chemists; for instance, the preparation of "liquid peptonoids," made by the Arlington Chemical Co., was sent to Dr. Ernst J. Lederle. This chemist found 17.59 per cent. alcohol by volume.

TABLE No. 51.—*Chemical Analyses by Dr. Ernst J. Lederle and J. A. Deghuee, Ph.D.*

An interesting comparison as to the alcohol content can be made by studying the analyses of the six nutritive tonics submitted for examination; they are:—

Nutritive Liquid Peptone…… (Parke, Davis & Co.)	23.49 per cent. alcohol by volume
Liquid Peptonoids …… (Arlington Chemical Co.)	17.59 per cent. alcohol by volume
Mulford's Pre-Digested Beef … (H. K. Mulford & Co.)	19.39 per cent. alcohol by volume
Tonic Beef …… (Sharp & Dohme)	17.04 per cent. alcohol by volume
Trophonine …… (Reed & Carnrick)	18.98 per cent. alcohol by volume
Panopepton …… (Fairchild Bros. & Foster)	20.05 per cent. alcohol by volume

CHAPTER VIII.

ADDITIONAL NUTRIENTS AND STIMULANTS.

MEIGS'S FOOD.

MEIGS'S food consists of milk, cream, sugar, gelatine, and arrowroot, and is prepared as follows: Of Russian gelatine or isinglass, 20 grains, or a piece about two inches square, is soaked for a few minutes in cold water, and then boiled in half a pint of water for fifteen minutes, or until completely dissolved. One teaspoonful of arrowroot is mixed to a paste with cold water, and then added to water to make half a pint. This is now added to the gelatine solution, as is also, with constant stirring, the desired quantity of milk; just before removing from the fire the cream is added. The amount of milk and cream used should vary with the age of the infant. For an infant under one month, 4 ounces of milk and 1 $^{1}/_{2}$ ounces of cream are to be used; for those older the milk is gradually increased to 16 ounces and the cream to 2 ounces.[1]

ZOOLAK.

The subjoined analysis of Dr. Dadirrian's zoolak was made by Edgar E. Wright, of Brooklyn, N. Y.

In every 100 parts of zoolak there are:—

Water	87.69
Proteid substances	3.98
Fat	4.91
Milk-sugar	2.03
Alcohol	0.07
Ash or mineral salts	0.78
Lactic acid	0.50
Carbon di-oxide	0.04

This analysis shows that in the production of zoolak but little change is wrought in the percentage composition of the original cows' milk, *save what would naturally be produced* by the fermenting and peptonizing actions of the kefir ferment.

These fermentative changes—primary and secondary—consist in:—

1. The transmutation of a portion of the natural milk sugar into alcohol, lactic acid, and carbon dioxide.

2. The transmutation of a certain percentage of the proteid substances into protoses, and finally, perhaps, into true diffusible peptones.

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[1] Meigs and Pepper: "Diseases of Children," 1887.

This latter action, however, does not change the percentage presence of the proteid bodies, as related to the total quantity of milk, but simply changes their chemical form.

Jurock's kefir-ferment-pastilles recently introduced in our country[1] are a very rapid and practical method of making kumyss. These tablets will keep indefinitely and can therefore be utilized wherever fresh milk can be obtained. Its nutritive value has been well established, in adults as well as children.

THE NUTRITIVE VALUE OF EGGS.

It is commonly asserted that an egg contains as much food value as a half pound of meat. This is not true. While there is an approximate equivalent between the albuminoids contained in both, the egg contains no carbohydrates. Very young infants do not digest eggs, and frequently gastric disturbances result from their use. This does not necessarily imply that the white of egg in its raw state should never be used as an adjunct to other forms of feeding, or as a temporary food when milk disagrees or when diarrhœal conditions, such as fermentative and catarrhal intestinal diseases, prohibit the use of milk.

LECITHIN.

Lecithin is a crystallizable fat of a peculiar nature containing nitrogen and phosphorus. It is unstable. When chemically treated by neurin and glycerine phosphoric acid can be isolated. Lecithin has also been found in the yolk of egg, in the eggs of fish, etc. Hoppe-Seyler isolated this substance in 1870 from its constant association with phosphorized albumins, nucleo-albumin, and nucleo-proteid. Lecithin is also found in the brain matter.

Free lecithin has been used clinically and physiologically by Danilewski in 1895. According to this physiologist animals fed with lecithin grew more rapidly than those not fed on this substance. It is a reconstructive and is indicated in the treatment of all disorders of nutrition. My experience with lecithin has been limited to rachitis, tuberculosis, and cases in which atrophy due to malnutrition is found, such as result from pertussis. I am also using it in cases of sporadic cretinism.

A preparation of lecithin containing one grain of pure lecithin to the drachm is made by Fairchild Bros. & Foster, of New York City. A teaspoonful of this solution given three times a day before meals has given me very good results.

Lecithin of the Egg.—According to Coloumbe, lecithin exists in all the tissues, especially in those endowed with great vitality. From a therapeutic point of view it is not toxic, and it is assimilated as a whole in ordinary doses. Its action consists in increasing the number of red corpuscles; in increasing, in certain cases at least, hæmoglobin; in increasing urea and diminishing uric acid; and in stimulating the appetite. Its employment is indicated in anæmia, in all troubles of nutrition, in wasting diseases, and in neurasthenia. It may be administered hypodermically or by the mouth.

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[1] By Dr. L. Amster.

STEAK JUICE OR MEAT JUICE.

The juice of broiled steak possesses anti-scorbutic properties. I have referred to this in the chapter on scurvy. When dentition is delayed or when the bony structure is weak, as in rickets, steak juice should be freely given. It is best prepared fresh each day. For this purpose a meat press (see illustration) is convenient. When fresh steak juice cannot be obtained, then Valentine's meat juice can be tried. For the treatment of scurvy fresh meat juice must be used.

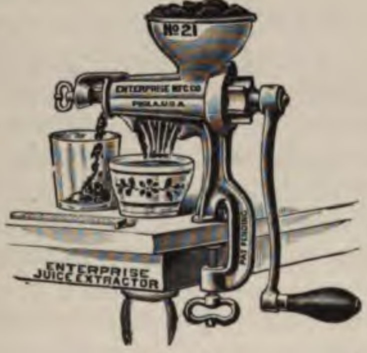

Fig. 53.

THE USE OF COCOA IN CHILDREN.

The value of cocoa as an infant food is underestimated, although a great many preparations of cocoa on the market are useless.

Indications.—When there is a tendency to diarrhœa and in general marasmic conditions, the nutritious effect of cocoa should be remembered. I frequently add one or two teaspoonfuls of cocoa to modify the curd in milk in the same manner as I prescribe some of the infant foods. During convalescence following the acute infectious diseases, especially diphtheria and scarlet fever, cocoa should be given. In pulmonary catarrh and in tuberculous manifestations, the use of cocoa is indicated. If milk is not well borne I frequently add one or two teaspoons of cocoa properly sweetened to rice water.

H. Cohn,[1] in describing the chemical value of cocoa as nourishment, states his belief that it is overrated, and denies the value of the same. He bases his statement on the poor method of assimilation, owing to the large quantity of fat which could be removed by chemical process. Cocoa also contains 5.5 per cent. of tannic acid. Besides, the albuminoids are converted, by the process of roasting, into a very indigestible product. About the tannic acid, he says that it precipitates the digestive ferments, and unites with the albuminoids into insoluble compounds, causing the constipating factor. According to his experiments, only one-half of the 16.6 per cent. of the albuminoids are absorbed, and, in order to give the human body enough cocoa to have a sufficient quantity of proteids, it would be necessary to feed at least somewhat over 2 pounds daily, provided cocoa alone was given for nourishment.

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[1] Zeitschrift für physiologische Chemie, xx, 1, 2.

A cocoa is found on the market in which a large percentage of oil has been extracted. This renders it more easily digested.[1]

CHOCOLATE.

Chocolate contains about 45 per cent. of cane sugar, but no dextrose or lævulose. The remainder consists of cocoa powder. Invert sugar, or a mixture of glucose and albumin, is largely used in the preparation of uncrystallized sweets, such as the creamy matter in the interior of chocolate drops. The coloring of sweets is derived either from burnt sugar or from one of the aniline dyes, most commonly eosin. Cochineal is also a favorite colorer. It is interesting to know that these dyes may be excreted in the urine almost unchanged, and cases are on record where patients were supposed to be passing blood when they had merely been sucking red sweets. There is no reason to suppose, however, that such substances are harmful to life.[2] When there is a tendency to loose bowels, especially after the second summer, cocoa and chocolate should be added to the dietary. It is to be added to milk and thoroughly boiled. One cocoa feeding per day is usually enough. One teaspoonful of cocoa to a cup of milk, the latter to be thoroughly boiled, is the usual quantity used. Several formulæ for making chocolate will be found in the "Dietary."

ICE-CREAM AND WATER-ICES.

Ice-cream and water-ices are very grateful to a feverish child. When milk and cream are refused they will be greedily taken. These preparations will alleviate the pain on swallowing in the case of diphtheria. They contain considerable nourishment, but must be given in moderation. Nausea and vomiting may frequently be controlled by them.

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[1] This cocoa is manufactured by Croft & Allen, of Philadelphia. It is put up in glass jars.

[2] Hutchison, "Food and Dietetics," page 265.

The Use of Coffee in Children.[1]

Contraindications.—When giving coffee to children we must bear in mind that:—

First.—Coffee is in no sense a food, because it can neither build up the tissues nor provide them with potential energy.

Second.—Coffee perhaps acts the part of a lubricant to the machinery of the body, and exerts its stimulating influence by toning up and diminishing nervous fatigue in adults, and is not called for in children.

Third.—Coffee produces a disturbance of digestion due to a direct *interference* with the *chemical* part of the process, but in part also indirectly brought about by the nervous system; it also produces a dyspepsia which is of the *atonic* type, and a slow digestion, accompanied by flatulence, with a disturbance of the heart's action, so that it is decidedly contraindicated from a feeding standpoint.

Coffee is a cardiac stimulant, quickening the heart's action in small doses, and depressing it in large quantities.

It certainly disturbs the cardiac rhythm when taken in excessive doses by children. Such symptoms are muscular tremor, nervous anxiety, and dread of impending danger, as well as palpitation; cardiac intermissions, and an uncomfortable feeling referred to the cardiac region can be traced to coffee, according to Yeo; it is a diuretic, and increases the excretion of *urea;* it produces insomnia, nervousness, and fear; also, choreiform movements.

Caffeine has been known to produce paralysis in the lower animals, and might produce a similar effect if taken in large quantities by children. It retards digestion, hence it is contraindicated in children.

Owing to the great tendency to produce insomnia coffee should not be administered in the evening unless the heart's action demands it.

Indications.—As a cardiac stimulant, or whenever caffeine is indicated, hot coffee should be given in small doses, one or several teaspoonfuls, repeated every fifteen minutes, until its physiological effect is manifested. This can only be noted by studying the pulse. Great care should be exercised in administering large quantities of coffee to children, or very strong coffee, as in either instance it will produce a marked cardiac depression, and also a disturbance of the cardiac rhythm.

In the convalescence of typhoid fever or pneumonia in children, there is no better stimulant than coffee administered in small doses to which large quantities of milk or cream are added. This is an especially valuable dose in the great cardiac depression so frequently noted in the convalescence of diphtheria. (See chapter on "Diphtheria.") The coffee usually used consists of the following strength:—

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[1] **Paper read by me before New York County Medical Association, December 17, 1900, "Acute and Chronic Coffee Poisoning." See Transactions.**

Coffee	2 ounces
Water	1 pint

When an infusion of the above strength is made, Hutchison found that each teacupful of coffee contained:—

Caffeine	1.7 grains; and also
Tannic acid	3.24 grains

The latter in the form of gallo-tannic acid; so that judging from this analysis, coffee should be made much weaker (one ounce to a pint of water), and should be administered in teaspoonful doses.

For fuller details on "Physiological Effect of Coffee," read paper and discussion at the New York County Medical Association, 1900, by Leszynsky, Fischer, and others.

The Use of Alcohol in Children.

Alcohol in the form of wine or beer or whisky, in any and every form, is not only detrimental to the infantile organism, but will leave permanent injury if its use is prolonged. There is a decided difference between the continual use of alcohol as a food and its use when indicated as a medicine. Physicians know that whisky or wine given to stimulate the weakened heart in the course of a fatal attack of pneumonia or diphtheria, is not only necessary, but frequently the only means of prolonging life. It can easily be seen that if a child has been brought up and given alcoholic drinks daily as an adjuvant to the other articles of food, that in such critical times when required to stimulate the heart we must either resort to enormous doses to procure a given effect or many times we will fail in producing a certain effect which may mean the loss of a precious life. Thus, it becomes necessary to emphasize the importance of abstaining from habitual feeding of alcoholic drinks in any form to the young and growing child.

In a large children's clinic with which I have been associated it was very interesting to study the amount of alcohol given to young children, and I was surprised to find that more than 50 per cent. of all children from six months old and upward regularly received their sip of beer or drop of whisky "to strengthen their hearts." The author has frequently attended alcoholic dyspepsia due to prolonged use of beer and wine. This is most common among the tenement population, where the baby forms part of the family at the table, and necessarily partakes of almost everything eatable and drinkable along with its parents.

THE USE OF TEA IN CHILDREN.

In my chapter on the use of coffee, I have already mentioned the deleterious effect of coffee on the growing infant or child; what has been said there regarding coffee applies equally strong to the use of tea. The nervous system when overstimulated in an infant is far more sensitive than the adult. The author has frequently noted that children suffered with sleeplessness and were very irritable, simply through the prolonged use of such stimulants as tea and coffee. A noteworthy point is that the appetite disappears when tea and coffee are given, and reappears when their use is interdicted.

It must not be supposed that tea is a poison, and there are times when physicians will find it necessary to use small quantities of tea to stimulate the body, as for example, in that form of exhaustion following a protracted diarrhœa, as is usually the case in summer complaint, so-called cholera infantum.

CHAPTER IX.

INFANTS' WEIGHT.

When a child develops normally, it gains in weight. Breast-fed infants, as a rule, gain more than bottle-fed infants. The progress of an infant can be watched by a comparison with its weight. The moment a child's weight is stationary, the reason for the same should be ascertained.

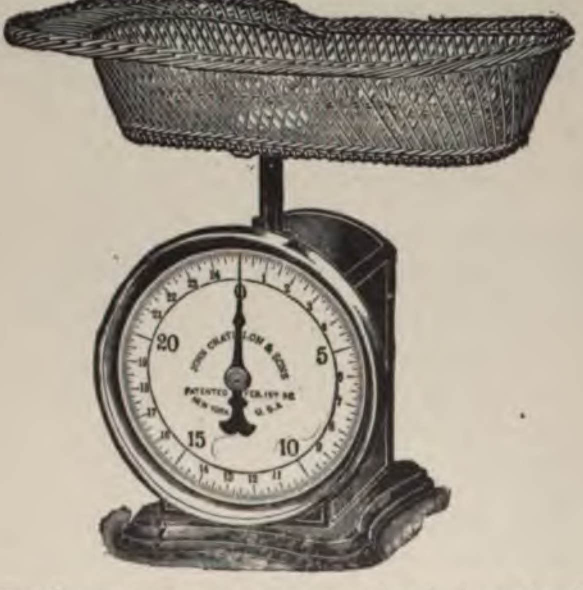

Fig. 54.—The Chatillon Scale is a very convenient basket scale. It is very useful in the nursery.

If the baby is breast-fed the milk of the nursing mother should be sent to a chemist for examination. (The details have already been described in the chapter on "Breast-milk.")

Disturbances of the mother interfering with proper lactation are at once evident in her milk. Such disturbances are: *(a)* menstruation, *(b)* general anæmia, *(c)* tuberculosis, *(d)* pregnancy will frequently alter the percentages of the ingredients of milk so that a child will not receive sufficient nutrition.

The first evidence of such malnutrition will be seen on the scales. The child will not gain in weight, and frequently it will lose weight.

How Much Should an Infant Weigh?—The average weight at birth is 7 pounds. Some children weigh considerably more and some less. A child should double its weight at the end of five months, and treble its weight at the end of the first year. It must not be supposed that because a child weighs less than this amount that it may not be healthy. All factors should be taken into consideration and a child should be carefully examined to determine whether or no it is normal. Very many babies are up to the normal in weight, and still show marked rachitis. The very fat and flabby baby—usually supposed to be extremely healthy by the laity—is the one in whom physicians most frequently meet with constitutional disorders. Thus, too much stress should not be put on the scales, for we know that they have their limitations. In the beginning, or during the first and second months, a normal infant gains about 6 to 8 ounces a week. During the third month a child gains from 4 to 6 ounces per week, and after the third month from 3 to 4 ounces per week.

Weighing Immediately After Nursing to Determine the Quantity of Milk an Infant has Taken.—When scanty milk supply is suspected in either the nursing mother or in a wet-nurse, then we can, in some instances, resort to weighing immediately after the baby has nursed. It is understood that the child must be weighed both immediately before nursing and then immediately after nursing. The difference in weight is the amount of milk swallowed.

While this may serve in some cases, the author has not found it very practical, and cannot recommend it, excepting in rare instances.

It is well known that an infant whose stomach is filled requires rest after nursing, and the less it is handled the less is the chance for expelling its food. Thus, my advice is not to handle or fumble with a child after nursing, but rather aid Nature in resting an infant than provoke vomiting by unnecessary handling.

TABLE No. 52.

Table Showing the Gain of a Healthy Infant Fed at the Breast.

Normal weight at birth, 7 lb.	Gain at the end of the first week, none.
Weight when 2 weeks old, 7 lb. 6 oz.	Gain at the end of 2 weeks, 6 oz.
Weight when 3 weeks old, 7 lb. 14 oz.	Gain at the end of 3 weeks, 8 oz.
Weight when 4 weeks old, 8 lb. 6 oz.	Gain at the end of 4 weeks, 8 oz.

The following cases will serve to illustrate the weight of infants with various methods of feeding—*(a)* breast-feeding, *(b)* home modification, *(c)* laboratory feeding:—

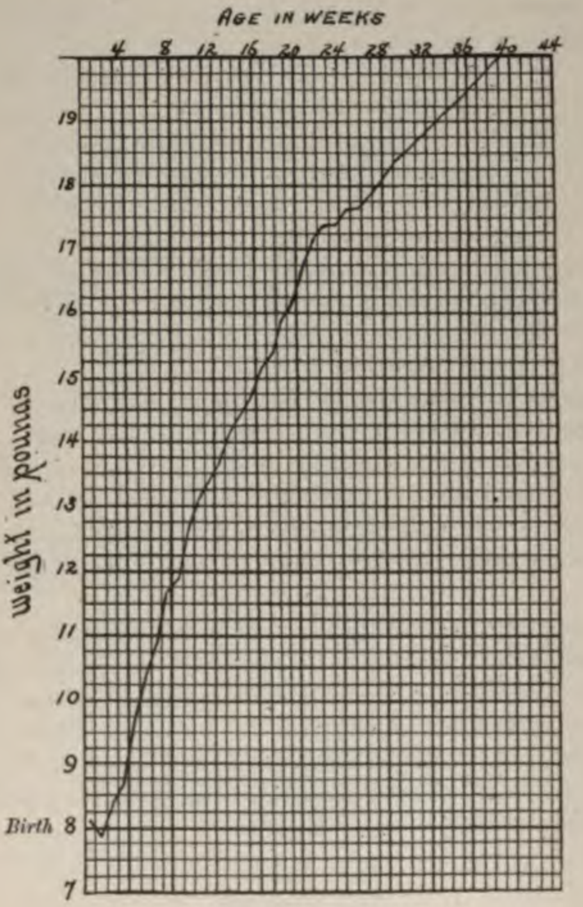

Fig. 55. (Original.)

Baby Robert M. F. Normal at birth. Was wet-nursed. Gain, first month, $2\,{}^{1}/_{4}$ pounds; second month, $1\,{}^{11}/_{16}$ pounds; third month, $1\,{}^{3}/_{8}$ pounds; fourth month, $1\,{}^{1}/_{8}$ pounds. Stools were normal. Had gastric disturbances and symptoms of colic while the wet-nurse menstruated. When the child was about seven months old the chemical analysis of the breast-milk showed a deficiency of fat and quite a high percentage of proteids. The milk supply gradually gave out and it was necessary to wean the child.

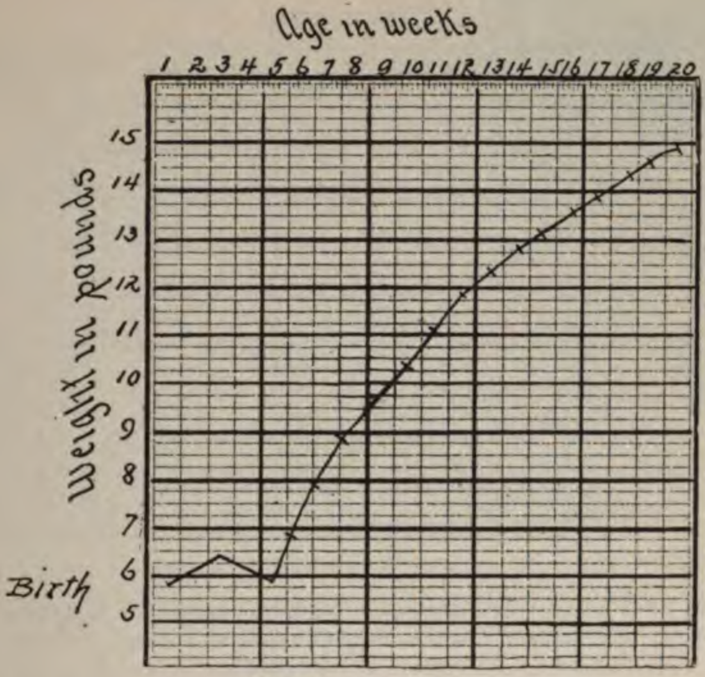

Fig. 56. (Original.)

Baby J. S. Born prematurely. Weighed 5 pounds, 14 ounces at birth. Was bottle-fed. Vomited, had dyspeptic symptoms, such as cheesy stools, restlessness at night, crying continually, and excoriated anus. When one month old the weight, including shirt and diaper, was 6 pounds. A wet-nurse was procured. The child gained 1 pound during the first week, and an average of 10 ounces a week thereafter. Dyspeptic symptoms disappeared, stools became normal. The child was not seen for six months, and is a perfectly healthy baby to-day.

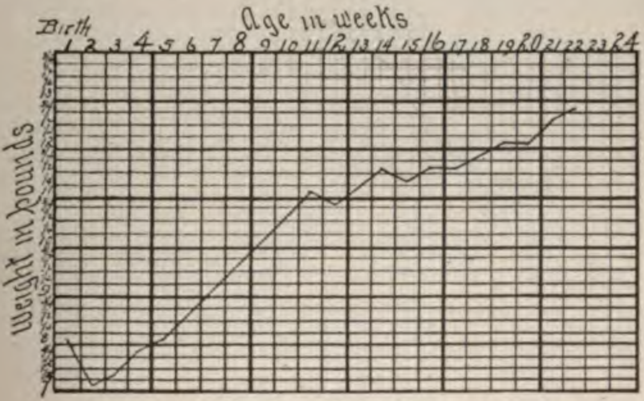

Fig. 57. (Original.)

From baby fed on Eskay's food since end of third week. General condition satisfactory, although somewhat constipated.

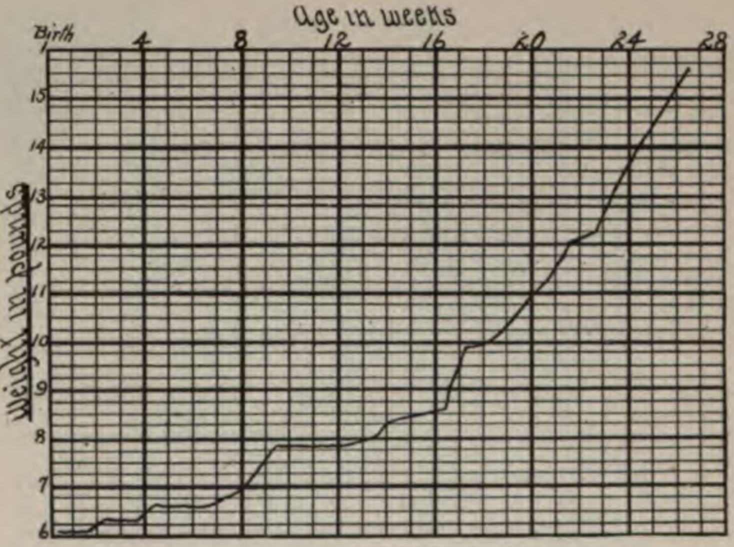

Fig. 58. (Original.)

Baby A. Case of chronic dyspepsia. Child four months old, weighed 8 pounds 15 ounces. Gained 13 ounces the first week of treatment; 6 ounces the second week; 7, 12, 9 ounces respectively during each of the succeeding weeks. The food ordered, and details of this interesting case on page 175.

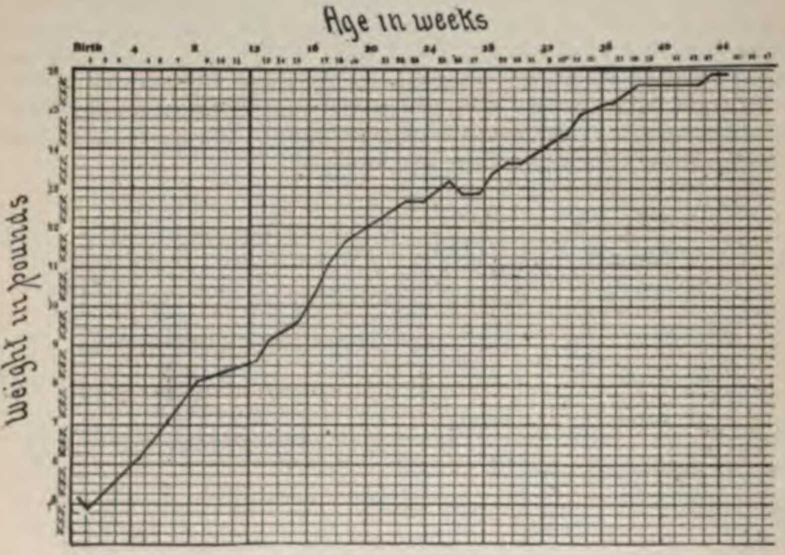

Fig. 59. (Original.)

Baby D. S. Weighed 5 pounds at birth. Was fed at Walker-Gordon Laboratory since six weeks old. Lost weight during an attack of measles when twenty-six weeks old. Did not gain one ounce from the thirty-eighth to the forty-second week, although received a formula of:—

Fat	4.00
Sugar	6.50
Proteids	2.50

Six feedings, of seven ounces each.

I ordered the following home modification:—

Raw milk	6 ounces
Barley water	2 ounces
Mellin's food	2 teaspoonfuls

Feed every three hours.

In addition thereto I ordered one ounce of steak juice or one ounce of orange juice, daily one hour before feeding.

I also gave the white of one raw egg with the evening feeding. The food agreed very well and child gained in weight as I gradually added more milk and reduced the quantity of barley water.

A growing child needs far more food than its weight alone would indicate, for its income must exceed its expenditure so that it may grow. An infant for the first seven months or first one-half year of life should have nothing but milk. Up to this age vegetable food is unsuited to it; it is purely a carnivorous animal.

The diet of the infant is nearly twice as rich in proteids, half as rich again in fats, and a little more than half as rich in carbohydrates as that of the adult. It is, therefore, in a physiologic sense a luxurious diet.

The strain of growth falls heavier upon the more precious proteids than upon the more cheap and common carbohydrates.[1]

When children do not gain in weight, the quantity of sugar should be increased. This should be done continuously and with due consideration for the other ingredients.

The constructive ingredient in an infant's food is the proteids. We must, therefore, consider this element when an infant's weight is stationary.

Individual conditions must be considered, and chronic disorders eliminated, *e.g.*, dyspeptic conditions or tuberculosis, before arriving at a diagnosis of what really causes an infant's loss in weight.

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[1] "Stewart's Physiology," p. 412, 1897.

PART IV.

DISEASES OF THE MOUTH, ŒSOPHAGUS, STOMACH, INTESTINES, AND RECTUM, AND DISEASES ASSOCIATED WITH IMPROPER NUTRITION.

CHAPTER I.

DISEASES OF THE MOUTH.

STOMATITIS.

AN infection existing on the tonsils or in the pharynx can spread to the mouth. Food, especially milk, is sometimes the means of directly conveying poison; this is especially true when milk contains pathogenic bacteria. As I have frequently stated that syphilis and rickets undermine the system, so also we find these conditions frequently as predisposing causes. The mouth is particularly liable to local infection. The slightest traumatism by diseased teeth, *especially in acute cases,* can produce local irritation. Non-pathogenic bacteria are always present in the buccal cavity under normal conditions.

"The glands of the mouth being excretory frequently produce inflammatory conditions by virtue of systemic poison excreted by them which may produce local lesions." One of the best writers on this subject is Forchheimer, whose classification I have adopted: I. Stomatitis Catarrhalis. II. Stomatitis Aphthosa. III. Stomatitis Mycosa. IV. Stomatitis Ulcerosa. V. Stomatitis Gangrenosa. VI. Stomatitis Crouposa; Stomatitis Diphtheritica. VII. Stomatitis Syphilitica.

STOMATITIS CATARRHALIS.

Simple stomatitis may be confined to a local area or it may be general. When the mucous membrane is irritated by severe rubbing as during mouth cleaning, this condition frequently follows. Dentition does not produce stomatitis. This catarrhal form is usually one of the earliest manifestations of acute infectious diseases. Great stress is laid on this condition as a diagnostic point in measles prior to or associated with the enanthem on the buccal mucous membrane. When a small area is affected, a local cause, such as a diseased or sharp tooth, or some mechanical cause, must be looked for.

Symptoms.—The usual symptoms of pain, hyperæmia, and swelling are noted. The lining of the mouth is puffed and hyperæmic. The mucous membrane is covered with small round prominences due to the swelling of the muciparous follicles. When the ducts of the latter become closed the glands dilate and there are produced cysts, the contents of which are clear, viscid mucus. We also find slight epithelial abrasions, sometimes leading to the production of a deeper process; at all events important in that they may become the seat of infection. The lymphatics are usually involved, and they serve as a guide to the intensity of the inflammation. Cases are on record where the temperature reached 104° F. in the rectum, but these are rarities.

The prognosis is invariably good. Unless some chronic disease is the seat of this trouble there are rarely any disagreeable after-effects.

Treatment.—The treatment consists in cleanliness. Remove the cause if possible. Remove mechanical irritants, such as diseased or sharp-pointed teeth. Boric acid, 1 per cent. solution, or sulphocarbolate of zinc or sulphocarbolate of soda, 1 grain to the ounce, are valuable local astringents. At times nitrate of silver (2 grains to the ounce) will act well when applied locally. Forchheimer recommends the application of silver nitrate when there is loss of epithelium. Cysts should be opened and their walls cauterized when necessary. My best results are obtained by the use of argyrol, 5 to 10 per cent. solution.

STOMATITIS APHTHOSA.

This condition is not follicular and has nothing to do with the muciparous follicles, as it is found in places where there are none.

It consists in a hyperæmia of the mucous membrane of the mouth associated with superficial ulcers.

Causes.—There seems to be a decided reason for believing that this disease is of microbic origin. Aphthous ulcerations have been seen in children partaking of milk from cows that suffered with foot and mouth disease. Demme[1] reports a case of twins fed on goat's milk, the goat having foot and mouth disease. The milk was fed fresh and raw. One of the twins, the boy, had a severe aphthous condition of the entire mouth and throat, and died after seven days of illness. The other, a girl, was also sick with aphthous sore mouth, but recovered after five days' illness.

Robinson[2] reports a severe epidemic of aphthæ acquired from foot and mouth disease in Devonshire. Two hundred and five persons were affected in one week. Two children died, the aphthous condition having extended to the respiratory tract.

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[1] Vienna Medical Journal, vol. vi, 1883.

[2] London Practitioner for 1884.

Gooding[1] reports a mother who drank milk from a herd affected by foot and mouth disease, and acquired an aphthous affection of the mouth; and, as she was nursing an eight-month-old infant, this infant was also affected with aphthæ from its mother's milk. The same author reports the case of an infant, twelve months old, that was infected from the same cow's milk, but recovered promptly when the milk was stopped. Three other children were also affected by the cow's milk, but recovered promptly when the milk was discontinued.

Friedberger and Frohner state, in their text-book on the "Pathology and Therapeutics of Domestic Animals" (the English edition, page 610): "That the use of milk from aphthous cows contaminates children quite frequently and is fatal to them."

Professor Brown, head of the Veterinary Department of the British Government, says: "Milk from cows infected with foot and mouth disease acts energetically on young animals when it is given warm; calves die quite suddenly after sucking cows affected with the malady, and fatal effects have followed the administration of the milk to guinea pigs."

Boas, of Berlin, has also reported cases of foot and mouth disease and their results. Bohn states that the disease is most common between the tenth and thirteenth months of life. Therefore teething has something to do with the eruption. Siegel studied an epidemic of foot and mouth disease, resulting in aphthous stomatitis in children. An ovoid bacillus 0.5 μ long was found in all cases. We can assume that foot and mouth disease in cattle is the etiological factor of stomatitis aphthosa in the human being.

Symptoms.—White or yellowish-white epithelial spots are seen singly or in groups, surrounded by an areola and developing anywhere in the mouth. Sometimes they extend into the pharynx, and Forchheimer believes into the larynx. This disease is frequently associated with acute gastric catarrh, constipation, and general toxæmic conditions. The eruption may be preceded by pain in the throat, fever, enlargement of the lymphatics, and a general train of nervous symptoms so common in children.

The diagnosis, therefore, will be difficult until the eruption appears. The spots frequently are absorbed. Successive crops may come and go.

Treatment.—The treatment consists in giving laxatives such as rhubarb and magnesia, or inf. senna comp. The diet must be regulated. If the child has been given solids they should be excluded. The discontinuance of milk is frequently beneficial.

Locally, a weak solution of listerine as an antiseptic can be used. If the child is old enough it should rinse its mouth and gargle its throat with the same. Nitrate of silver, 10 grains to the ounce, or in some instances tincture of chloride of iron, has served me very well. The glycerite of carbolic acid applied with absorbent cotton is frequently efficacious.

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[1] Medical Times and Gazette of London, 1872.

BEDNAR'S APHTHÆ.

These are seen on the soft palate. They may be mistaken for the ulcers produced by the breaking down of milia or retention cysts, or from that condition described by Epstein in which there are congenital defects in the mucous membrane filled up with epithelial detritus (Forchheimer). They are always the result of violence in cleaning the mouth. They are benign and get well without treatment. Frequently an improperly-shaped nipple will cause this condition by pressing on the palate. Changing the nipple will remove the cause.

Dr. A. Jacobi, in the Archives of Pediatrics, says:—

"Do not be so *fearfully* clean. Perhaps it is best to leave the infant's mouth alone with the exception of the first washing with sterilized water immediately after birth. Otherwise the mouth should be cleaned by the baby's feeding and by the practice I have recommended these dozen of years —viz.: to give a teaspoonful or two of water after every feeding. That will wash down all remnants of food that might get decomposed in the mouth. These 'aphthæ' will get well when left alone; but as long as there is a sore surface there is a possibility of microbic invasion; for that reason alone they should be treated. Use a soft brush in the mouth every hour with a few drops of chlorate of potassium solution, one to thirty, or milder, but do not rub or be rough."

STOMATITIS MYCOSA, OR PARASITIC STOMATITIS.

This disease is commonly known as thrush, sprue, soor, or muguet. It occurs in the mouth in the form of yellowish-white spots and is due to a microbe. A fungus was first discovered by Berg, of Stockholm, and called *oïdium albicans* by Robbin. Forchheimer states that the fungus is found in two forms, the yeast form and the globulo-filimentous form (frequently called mycelium). "There is no ascospore, therefore. Roux and Linoissier state that the fungus is not a saccharomyces. The chlamydospore has, however, not been satisfactorily worked out."

Propagation goes on in three ways: by filaments produced from conidia, by isolated conidia, and by spores.

Symptoms.—Local symptoms vary with the severity of this condition. At times no symptoms precede the appearance of these small spots. The spots are grayish-white or creamy in color. They may be elevated above the surface of the mucous membrane. They are not confined to the gums, but appear frequently on the lips, tonsils, pharynx, and cheeks. There is a fetid breath due to the inflamed gums. Children that are old enough to complain do not describe any subjective symptoms. The lymphatic glands are always enlarged and do not suppurate. When suppuration takes place it will follow after the disease in the mouth has disappeared.

· **Treatment.**—*Prophylactic treatment* of the mouth, consisting in the usual hygienic measures, can prevent this condition. Aseptic details must be rigidly enforced in the nursing bottles and nipples when this disease is present.

Treatment consists in the application of a 1 per cent. boric acid solution as a mouth cleanser, followed by the local application of a 3 per cent. chlorate of potassium solution. Where a specific cause exists, such as carious teeth or dead bone, the same should be removed before attempting to cure this condition.

CROUPOUS STOMATITIS, OR DIPHTHERITIC STOMATITIS.

This rare condition is occasionally met with in children. The prognosis and treatment should be considered just the same as though we were dealing with diphtheria in the throat. The following interesting case was sent to my clinic at the New York Post-Graduate Medical School in 1894:—

The child was seven months old, female, breast-fed, had always been in good health. No family history of tuberculosis, lues, rheumatism, or epilepsy. The child was vaccinated when about six months old, had had no previous illness excepting slight irritability about the time of the eruption of the first tooth. It has two teeth, incisors, lower jaw. General appearance not anæmic or rachitic, has well-nourished muscles and a fair amount of fat. Skin has a healthy appearance. Four other children in same family; three apparently healthy, the fourth is convalescing from an attack of "sore mouth." The infant has been gaining weight regularly since birth. It now weighs 15 pounds and 8 ounces.

An examination of the infant showed: Two large patches—one on the tip of the tongue, the other on the soft palate—which were irregular in outline, yellowish-green in appearance. Temperature in the rectum 100 $^{1}/_{5}$° F., at 11 A.M.; pulse, 142; respiration, 39. Cervical glands considerably enlarged on both sides. No history of existing infectious disease in the same locality. The diagnosis of stomatitis ulcerosa was made and a question mark (?) entered after the same. Diphtheria was suspected. The mother was cautioned in regard to the other children, and the case carefully watched. I again saw the case two days later and found the child in a worse condition. The temperature in the rectum at 4 P.M. was 102 $^{1}/_{5}$° F.; pulse, 160; small, feeble, but quite regular. The examination of the mouth showed an extension of the inflammatory condition of the patches, now involving the uvula and left tonsil. The pharynx showed an abnormal redness, but no membrane was visible.

The mother's breast was painful on palpation. The glands were distended with milk, and the axillary glands enlarged and tender on palpation. The mother complained of aching in her limbs—a "tired feeling," as she called it—and had chills, alternating with fever. Her temperature was 99 $^{4}/_{5}$° F. in the mouth. There were membranous patches around one of her nipples. This resembled a cracked nipple. While examining the infant's mouth I saw what appeared to be membrane. A similar condition was found around the nipple. I inoculated two agar-agar tubes and placed them in the thermostat. After thirty-six hours, small colonies of both streptococci and bacilli could be seen. On staining with Loeffler's alkaline methylene blue, showed distinct semblance to Klebs-Loeffler bacilli. A culture was made from the patch in the mouth, from the uvula, and also from the pharynx. The tube inoculated with the uvula patch and the one from the tongue contained, in almost pure culture, the characteristic Klebs-Loeffler bacilli. The usual method of treatment and active stimulation was given. Concentrated liquid diet (rectal feeding) was given when the infant refused the breast. An important question suggested itself: Shall we wean the infant? or, mother and infant having the same disease, could the infant be nursed on the healthy breast? It will be remembered that only one nipple was diseased. I resolved to give the infant the milk of the healthy breast and to guard against another sore nipple by nursing through a glass nipple shield. The milk in the diseased, or left, breast, was drawn out with a breast-pump and thrown away.

Three weeks after the apparent cure of the mother's breast and also after the last visible membrane from the infant's throat disappeared, the mother complained that she slept with one eye open. On examination, I found a distinct facial paralysis on the right side. The *diagnosis* was strengthened by the sequel in the case. To sum up: I believe the infant, while having diphtheria, infected its mother through the fissure of the breast during the act of nursing. Considering the physiology of nursing, we know the rôle played by the tongue, and as the disease was first manifested thereon, it can be readily seen how this might have been inoculated from tongue to the breast through its cracked nipple.

SYPHILITIC STOMATITIS.

Primary infection in syphilis is by no means rare. It usually occurs by transmission from a wet-nurse suffering with syphilis.

A case of this kind was seen by me in an infant nine months old. This infant was accidentally infected by a woman who nursed it during the mother's illness. She had erosions (cracked nipples) and did not know that she suffered with syphilis. Her own child died of distinct syphilis, having had pemphigus and the general cachexia so common in *luetic* conditions. This case was given small doses of calomel, and given a bichloride bath (see chapter on "Syphilis") and showed signs of improvement almost immediately. In the mouth of this child the ordinary mucous patches were found.

Treatment is that of syphilis. (See chapter on "Syphilis.")

STOMATITIS GANGRENOSA (NOMA: CANCRUM ORIS.[1])

This disease is frequently called noma, and sometimes cancrum oris. It is characterized by a gangrenous destructive process located on the cheek. Although the left cheek is the favorite site of the disease, it can frequently be found on both cheeks. The writer has met with children suffering from this disease on the right cheek. Girls are more liable to noma than boys. It is usually secondary to some infectious disease, and has been known to follow typhoid fever, smallpox, scarlet fever, measles, pertussis and allied infectious disorders. We must therefore assume that the infectious diseases are predisposing factors in the development of this disease.

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[1] Extracted from the American Journal of the Medical Sciences, April, 1902.

Some authorities claim that noma frequently is a sequel to infectious diseases.

The process usually commences on the gums or the inner portion of the cheek, and spreads very rapidly to the adjacent tissues. Thus it is that it will destroy the inner portion of the cheek and spread to the outside, causing similar destruction to the healthy tissues. From the nature of the method of spreading it appears to be of a specific nature. Whether or not a specific micro-organism causes this disease has not yet been definitely determined. We know, however, that it commences similarly to a diphtheritic process and spreads in the same manner. Weak children, as those above mentioned, that have passed through severe infections, are the ones usually attacked by this disease.

Symptoms.—The cheek will appear swollen, hard, and œdematous to the touch, the œdema causing such swelling that frequently the eye of the affected side cannot be opened. There is a decided fetor to the breath, which is often the first symptom noticed. The disease spreads very rapidly from the gums to the cheek. Frequently the teeth will loosen and fall out. The latter is frequently caused by the previous administration of mercury. Thus it is that great care should be used in giving mercury to children.

That it is not an inflammatory disease can be seen by the fact that the temperature is rarely or never above normal. The swelling can best be felt by opening the mouth and grasping the cheek between the thumb and forefinger. The skin over the induration is frequently mottled with purple spots resembling ecchymoses. The appetite is diminished, partly due to the fear of pain caused by chewing.

Some authorities state that children so affected have diarrhœa. Forchheimer believes that hæmorrhages rarely occur, owing to the blood-vessels being filled with thrombi.

When this gangrenous mass discharges we will find a dirty, fetid saliva, with threads of broken-down tissue. The cervical glands in the immediate vicinity are always found enlarged. In severe cases it is not rare to have the parts ulcerate and even perforate the cheek after several days. When the disease extends inward, not only does periostitis occur, but necrosis of the jaw-bone has been noted. When the disease is as malignant as has just been described, then subnormal temperature, possibly delirium, may complicate the condition. The disease may extend to the lungs, causing a gangrenous infiltration. When the gangrene affects the genitals in girls, then a serious prognosis must be given.

Starr maintains that noma makes its appearance uniformly at one point on the cheek, and is unilateral, which suggests a localized causative lesion. The most natural theory, that of embolism of a large arterial branch, due to weakness of the cardiac muscle or increased coagulability of the blood—effects of the primary disease—is untenable, because, with the given conditions, emboli ought, at least occasionally, to be found in other positions, which does not happen. It is necessary to look rather to the nerves—namely, the trifacial, the facial, or the vasomotors. That the gangrene is due to a lesion of one of these seems to be borne out by experiments. Thus Magendie found that division of the trifacial in dogs caused destruction of the corresponding eyeball, and half of the tongue became dry, brown, and fissured, the gums spongy and hæmorrhagic, and the teeth loose. "In animals tenacious of life—the batrachians, for example—the soft portions of the face are cast off in shreds, just as in spontaneous gangrene. After three or four weeks only one-half of the face remains."

A variety of bacteria can be found at the seat of lesion, but their presence has no etiological significance. The body of a child dead from noma has a gangrenous odor and decomposes quickly; the skin is shriveled and the face and the feet are œdematous. The gangrenous parts are converted into a blackish-brown mass, and the maxillary bones are naked, brownish in color, and brittle. The nerves, when examined microscopically, are yellowish in color but unaltered in structure, and the blood-vessels are thickened and filled with thrombi. In the uninvolved parts of the cheek there is a dense exudation, while the palate, tongue, and tonsils are swollen and covered with black scales and crusts. The lungs are the seat of hæmorrhagic infarctions, lobular or metastatic lobar pneumonia, and sometimes gangrene. The intestines are catarrhal. Evidences of the primary disease may also be present; for example, the lesions of typhoid fever or dysentery.

The following case will illustrate the condition described:—

Elsie G., aged 7 years, was seen by me in January, 1900. The child had complained of severe headache for three or four days, and was very feverish. Her mother became alarmed because of persistent vomiting. She stated that the child vomited at least six times in twenty-four hours. She complained of feeling fatigued and had pains in her arms and legs.

Small doses of quinine were given the child, but did not seem to relieve the present condition.

The child was nursed for ten months, and was a strong baby up to this time; dentition commenced at the seventh month; the child's muscles and bones were well developed; there were no evidences of rickets; the first two years were passed without any sickness except an occasional attack of constipation. The child walked at the end of the first year and commenced talking at its fourteenth month. Twenty teeth—"milk teeth"—appeared at the end of two years. The child had measles in its third year, which left a bronchitis; the mother states that this same cough recurs every winter. The child has had whooping-cough, lasting four months, which was so violent that it had epistaxis almost every day for one month. This whooping-cough was so severe that, in addition to the nose-bleed, the child vomited almost continuously. From loss of sleep, in addition to the above-named symptoms, the child commenced to emaciate. This was at the end of her fifth year.

She lost twelve pounds in two months, and the mother states that since that time she has been very puny and delicate. There is also a hernia directly traceable to the violent paroxysms of cough.

The mother suspected the child was suffering from malaria, or possibly an attack of grip. When the child was undressed an eruption was found all over the body, which was that of typical scarlet fever. The throat was filled with evidences of pseudo-membranous patches which were distinctly scarlatinal in character. The temperature was 103.4° F., taken in the rectum; pulse, 128; respiration, 22. The child was put to bed and an expectant plan of treatment ordered, in addition to a very light liquid diet consisting of soup, milk, buttermilk, broth. Nothing else was allowed; no solids were given. For the thirst I ordered orange juice and apple sauce. Small doses (wine-glasses) of citrate of magnesia were given for their laxative and diuretic effects.

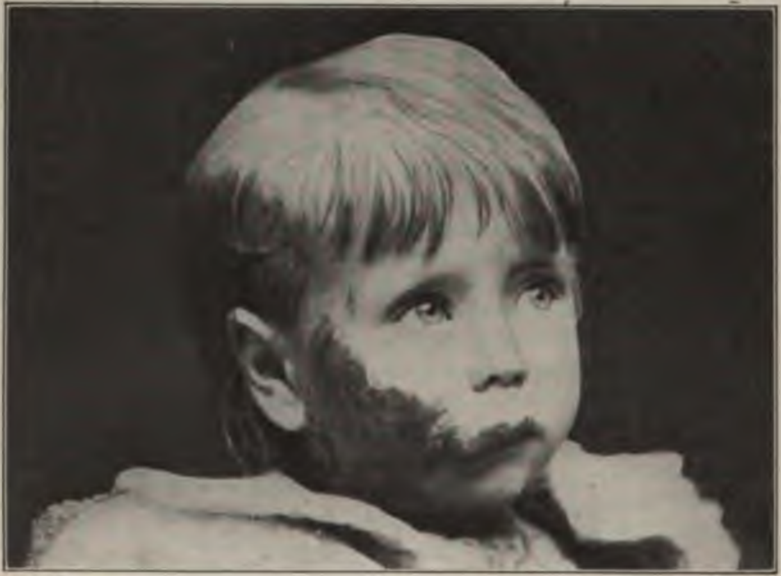


Fig. 60.—Case of Stomatitis Gangrenosa (Noma) Following Scarlet Fever. The picture shows the unilateral gangrenous condition involving the right cheek and the lips. Case recovered. Clinical history given in the text. (Original.)

Desquamation followed in the second week in the usual manner. The urine showed traces of albumin in the second week, which increased until that time—6 per mille, according to Eschbach's albuminometer—hyaline and epithelial casts were found in great numbers. There were also large quantities of blood-corpuscles visible under the microscope. The urine was quite red from the blood that it contained. At the end of the third week there was quite an anuria. This latter condition was relieved by the application of several dry-cups over the region of the kidneys. Five to 10 grains of diuretin internally were ordered every four hours. Citrate of potash was given, 5-grain doses combined with large quantities of Apollinaris and lithia water. After three weeks of patient treatment the child recovered.

The heart sounds were not only very feeble, but thready, and a loud, blowing, hæmic murmur, which was attributed to the anæmic condition, was audible. Iron was given in the form of the syrup of iodide of iron; hypophosphites were also administered as restoratives. Convalescence lasted in all until April, a period of almost three months from the time of the child's first illness. About this time she complained of pain in the gums and on the cheek while chewing. Later, the foul breath attracted attention. At first this condition was attributed to the teeth, but a dentist who saw the child found the teeth and gums healthy. The ulceration, which had now become quite marked, from the size of a silver dollar, spread with remarkable rapidity. Its color was that of a dirty, blackish-gray, and had purpuric spots scattered around the edges of this ulceration, resembling subcutaneous hæmorrhages. On examining it considerable fluid, which was very foul smelling, exuded on pressure. Antiseptic lotion, consisting of 50 per cent. peroxide of hydrogen diluted with water, was ordered as a mouth wash. The child was told to rinse the mouth every half-hour, especially after eating. The gangrene extended to the outside of the cheek, involving, as can be seen by the illustration, almost the whole cheek. The picture was taken after the child had had its mouth and its cheek thoroughly cauterized by using the Paquelin cautery. Ichthyol was applied in the following manner:—

℞ Ichthyol one part and lanolin ten parts.

M. Ft. ungt. Sig.: Apply over the whole of the gangrenous surface by rubbing the parts thoroughly, the same to be repeated at least three or four times a day.

The ichthyol seemed to serve remarkably well in this case. The same was continued for about three weeks, when the child was discharged as cured.

EPITHELIAL DESQUAMATION (GEOGRAPHICAL TONGUE).

A very common condition consists of epithelial desquamation of the tongue, giving rise to irregular, round or crescent-shaped patches. The borders of these patches are surrounded by a thickish, grayish margin. The center has a glazed appearance. From the irregular outline resembling a map the name of geographical tongue originates.

There are usually two or more of these red patches seen at one time. They last weeks and months. I have met these cases among the poorest hygienic surroundings and have seen the same condition among the wealthy. Malnutrition seems to be associated in all my cases. I have frequently seen cases of this kind among the children suffering with diphtheria at the Willard Parker Hospital, especially during convalescence. The following case illustrates this condition:—

Minnie H. Fourteen months old. Has been in delicate health since birth. Although breast-fed, has always been constipated and suffered with gastritis, and vomiting occasionally.

She is very anæmic. Can neither stand, walk, nor talk. Dentition has been delayed; there is no sign of teeth. The tongue shows four large irregular shaped patches and two smaller ones in the center. They appear as though a coated tongue had irregular patches of red, and shining flesh interspersed. Diagnosis, rickets and geographical tongue.

Treatment.—Increase the proteids and fats to stimulate nutrition. Cleanse the tongue with boric or tannic acid solution. Most authors advise no treatment.

CONGENITAL HYPERTROPHY OF THE TONGUE.

A thickened swollen tongue is always seen in sporadic cretinism. (See chapter on "Cretinism.") The specific thyroid treatment will usually modify this enlargement. When diseased lymphatics exist we may have a lymphangioma. Such conditions are rare, and if present require surgical treatment.

BIFID TONGUE.

Brothers reported a case of this kind to the New York Pathological Society. The child was one month old, had a cleft tongue and a fissure of the soft palate.

BIFID UVULA.

This condition is occasionally seen. I have seen bifid uvula several times without cleft palate. Some authors report the co-existence of bifid uvula with cleft palate. It requires no treatment.

GLOSSITIS.

An inflammation of the tongue is very rare in children. Some authors state that it is due to traumatism, such as biting the tongue in an epileptic fit, or a ragged sharp tooth may infect the tongue and cause inflammation. Any irritation, such as caustic acids or alkalies, may cause inflammation.

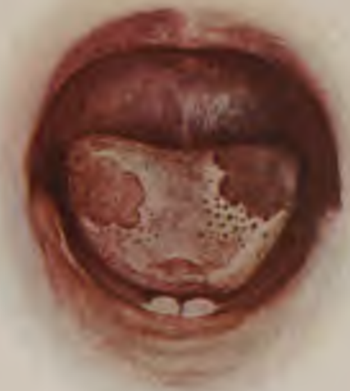
The following case occurred in my private practice:—

A child 1 year old was bottle-fed, and suffered with severe constipation. He was backward in development, had no teeth, could neither walk nor talk. Several adults in the family had influenza and the child was exposed and infected. The fever reached 104° F. There was anorexia, cough, and running of the nose. The tongue was thickened and inflamed and protruded from the mouth. He refused to take any food and seemed relieved when a piece of ice was placed on the tongue. Ice cream was ordered to nourish and cool at the same time. Rectal suppositories containing aconite, 1 minim, and sodium salicylate, 3 grains, were ordered every two hours. Under this treatment, aided by ice applied on the tongue and an ice collar on the neck, the swelling of the tongue disappeared in about four days.

RANULA.

A swelling in the floor of the mouth, located on either side of the frænum, is frequently met with in children. It is a cyst varying in size,

PLATE VII



Geographical Tongue, Associated with Gastric Fever.
(Original.)

and is due to an occlusion of the duct leading into the mouth from the sublingual gland.

Character.—It may be simple or multilocular. It may be of such proportions as to interfere with proper nutrition.

Symptoms.—The symptoms are those of a mechanical obstruction of a non-inflammatory character. It is painless, soft, fluctuating, and contains mucus. The color of the growth is the same as that of the adjacent parts.

Treatment.—An incision should be made to evacuate the contents of the sac. The interior of the sac should be cauterized with iodine or nitrate of silver. In some instances the Paquelin cautery may be required.

ALVEOLAR ABSCESS.

When there is defective hygiene in the mouth and the teeth are not properly cleaned, caries of the teeth results. The carious condition frequently sets up an inflammation and pyogenic bacteria gaining entrance cause abscess formation at the root of the tooth.

Symptoms.—The symptoms are pain, swelling, fever, interference with feeding, foul breath, and general constitutional disturbances. The diagnosis can be made by the presence of fluctuation in the mouth, by the swollen face, mouth, and jaw.

Treatment.—Locally, warm (dry) chamomile bag or warm (moist) flaxseed poultices will have a soothing effect, used externally over the swelling. Rinsing the mouth with warm chamomile tea to which a few drops of listerine has been added is grateful. Painting the gums with equal parts of tincture of iodine and tincture of opium every hour will relieve pain. If fluctuation is detected an incision should be made into the gums on the inner surface, and the pus evacuated. If this condition is neglected the periosteum of the jaw may be involved and the pus will burrow and evacuate itself spontaneously, leaving a disagreeable fistula. Cases have been reported where neglect of this condition has resulted in necrosis of the jaw.

CHAPTER II.

DISEASES OF THE ŒSOPHAGUS.

ACUTE ŒSOPHAGITIS.

AN inflammation may extend from the pharynx into the œsophagus. When such conditions arise the symptoms of pain on swallowing are associated with fever. The treatment consists in giving bland food, milk, seltzer, and alkaline waters or water containing bicarbonate of soda.

CROUPOUS OR DIPHTHERITIC ŒSOPHAGITIS.

Diphtheria can invade the œsophagus as well as it can spread to the larynx. Some authors describe croupous inflammatory patches in the œsophagus. I have seen diphtheria of the œsophagus and also a diphtheritic patch post-mortem in the stomach of this same case. Such a condition is invariably serious and recovery is rare. *The treatment of diphtheria affecting the œsophagus is the same as that described in the chapter on "Diphtheria."* When dysphagia occurs and there is an interference with deglutition, rectal feeding may be demanded to save life.

If severe pain exists give morphine or codeine in suitable doses. Nausea and vomiting can best be controlled by giving large doses of chloral. If an œsophageal stricture remains then surgical treatment will be required for which the reader is referred to modern text-books on surgery.

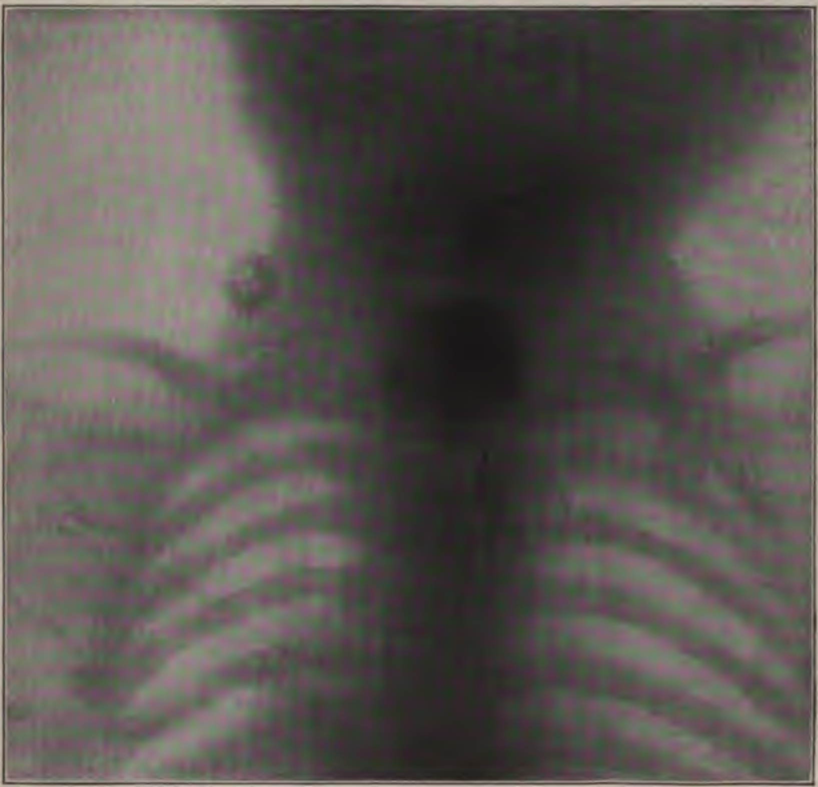
RETRO-ŒSOPHAGEAL ABSCESS.

This condition may follow measles, scarlet fever or diphtheria, in fact, it may be associated with any infectious disease. As a rule this disease consists of a breaking down of the lymph glands ending in suppuration. In a case seen by me the streptococcus was found. This condition is also frequently associated with tubercular conditions. The following case will illustrate the type most frequently met with:—

I was called in consultation with Dr. S. Brothers to see a child 3 years old with the following history:—

There was fever, an irritant cough, stertorous breathing, and evidence of obstruction pointing to the larynx. The neck was swollen and the glands enlarged. The temperature was 102° F.; pulse, 130; respiration, 36. At first the case resembled one of laryngeal stenosis as is usually found in diphtheria. The dyspnœa was so marked that intubation was suggested. The symptoms of dyspnœa continued and an incision was made into the posterior pharyngeal wall. The abscess cavity extended into the œsophagus. Caries of the dorsal vertebræ was associated with this condition. The child died from inanition. The tubercular process was evidently

PLATE VIII



Radiograph of Whistle, which was swallowed by a child, and imbedded in the œsophagus. (See N. Y. Med. Record, March 16, 1901. Case of Dr. A. E. Isaacs.)

responsible for the abscess, which consisted of pus and large curded masses. The diagnosis was made after a careful study of the case. It is not an easy matter to diagnose this condition, as it is absolutely impossible, in some cases, to reach the abscess cavity by a digital examination of the pharynx.

In the case above reported the dyspnœa was very alarming. The literature records cases of spontaneous evacuation of the abscess into the œsophagus resulting in recovery, but usually these cases end fatally. The treatment is surgical, and tuberculosis, if present, requires the usual form of treatment. (See chapter on "Tuberculosis.")

FOREIGN BODIES IN THE ŒSOPHAGUS.

I have frequently been consulted regarding the removal of buttons, coins, etc., which were swallowed. The habit of children to put everything into the mouth should be remembered when buying toys.

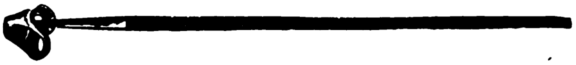


Fig. 61.—Hinged Bucket.

The best method of extracting foreign bodies in the œsophagus is by means of the hinged bucket, also known as the "coin catcher."

CHAPTER III.

DISEASES OF THE STOMACH.

THE INFANTILE STOMACH.

THE infantile stomach is vertical and cylindrical and the fundus but little developed. Thus, whenever there is a tendency to vomit, the antiperistaltic motions do not press against the fundus, but directly upward. There is, therefore, rather an overflow than a vomiting of the gastric contents; this takes place so easily that the babies are not disturbed by it.[1]

Anatomy.—The muscular development is weakest at the fundus. According to Fleischmann, the oblique and the longitudinal fibers described by Henle, which have their origin at the pyloric opening, "do not exist in the infant." The investigations of Leo and von Puteren show that, in spite of this lack of muscular development, the stomach of a nursing infant is emptied in one and a half or two hours. With food that is more difficult to digest, the gastric contents are propelled more slowly.

The Mucous Membrane of the Stomach.—The mucous glands are far more numerous on the pars pylorica than in adults, whereas they are far fewer in number at the cardia.

The mucous membrane of the infant secretes gastric juice which, in general, is similar in properties to that of the adult. The amount of secretion in the infant is *far less* than in the adult, while its chemical constitution is the same, namely: pepsin, lab-ferment, and acids. The exact proportion of the ferment and pepsin has not yet been studied sufficiently to admit of any positive deductions being made.

Physiology.—It is very important to know that the mucous membrane of the mouth is practically dry at birth; the secretion of saliva is very small, and, according to Korowin and Zweifel, increases toward the end of the second month.

The fermentative (sugar-forming) property of saliva, which is trifling at the commencement, increases with the quantity of the saliva secreted. This is essentially true of other secretions; thus, the pancreatic juice does not have the same emulsifying properties in the infant as in adults.

The nursing or sucking center is located, according to experiments made on animals by Basch, in the medulla oblongata on the inner side of the corpus restiforme.

The sucking act is reflex; according to Auerbach, the muscles of the tongue participate most actively.

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[1] Jacobi, "Therapeutics of Infancy and Childhood," page 25.

Acids in the Infant's Stomach.—The gastric contents in a nursling contain two acids: (1) hydrochloric acid; (2) lactic acid. The relative acidity is smaller than in adults, the highest point being reached one and a half hours after nursing. According to von Puteren, the acidity is two and one-half to three times as small as in the stomach of adults. According to Leo, the acidity of the gastric juice of nurslings 1 $^1/_2$ hours after drinking is only 0.13 per cent., whereas, in the adult, after the same time, the acidity is from 1.5 to 3.2 per cent. According to Wohlmann, free HCl can be found in healthy nurslings from 1 $^1/_4$ to 2 hours after taking food. The percentage of free HCl ranges from 0.83 to 1.8 per cent.

Lactic Acid.—The quantity of lactic acid is, according to Heubner, between 0.1 and 0.4 per cent.

Pepsin and Hydrochloric Acid.—There are two chief functions of the pepsin and hydrochloric acid which are the same in both infant and adult: First, the power of killing bacteria: a real bactericidal power. Second, as a solvent for albumin. Thus, it is apparent that pathogenic micro-organisms that might have entered the stomach can be destroyed, although we know the small quantity of acid is hardly able to cope with large quantities of food contaminated with bacteria.

Unorganized Ferments.—The unorganized ferments seem to be nitrogenous bodies; their exact composition is unknown, and it is doubtful if they have ever been obtained perfectly pure (Landois and Stirling).

Action of the Saliva on Various Bacteria.—Triolo describes a series of interesting experiments with saliva. He first irrigated the mouth with bichloride or permanganate of potash solution, followed this by irrigation with sterilized water until the disinfecting substances were removed, and then inoculated the surface of various culture-media with the sputum. His results proved that saliva possesses a distinct bactericidal property, for cultures of five-day-old bacteria were destroyed, as well as fresh bacteria eighteen hours old.

This property, however, was lost when saliva was filtered. The saliva of the parotid and submaxillary glands, taken singly, were equally efficacious as their combined secretion. He believes that the greatest bactericidal action is due to the secretion of the mucous glands in the mouth.

The Influence of Gastric Juice on Pathogenic Germs.—Gastric juice is, according to the experiments of Drs. Kurlow and Wagner, an exceedingly strong germicidal agent, and when living bacilli get into the intestinal canal it is due to various conditions entirely independent of the gastric juice. When the latter is normal and in full activity, only the most prolific microbes—such as tubercle bacilli, the bacilli of anthrax, and perhaps the staphylococci—escape its destructive action; all others are destroyed in less than half an hour. Similar influences exist in the intestines, as proved by inoculation with the cholera bacilli.

TABLE No. 53.—*Showing the Unorganized Ferments Present in the Body and Their Actions.*

Fluid or Tissues.	Ferment.	Actions.
Saliva . . .	Ptyalin	Converts starch chiefly into maltose.
Gastric juice . .	1. Pepsin	Converts proteids into peptones in an acid medium, certain by-products being formed.
	2. Milk-curdling.	Curdles casein of milk.
	3. Lactic-acid ferment. . . .	Splits up milk sugar into lactic acid.
	4. Fat splitting.	Splits up fats into glycerine and fatty acids.
Pancreatic juice .	1. Diastasic, or amylopsin . .	Converts starch chiefly into maltose.
	2. Trypsin	Changes proteid into peptones in an alkaline medium, certain by-products being formed.
	3. Emulsive (?)	Emulsifies fat.
	4. Fat-splitting or steapsin .	Splits fat into glycerine and fatty acids.
	5. Milk-curdling.	Curdles casein of milk.
Intestinal juice	1. Diastasic	Does not form maltose, but maltose is changed into glucose.
	2. Proteolytic	Fibrin into peptone (?).
	3. Invertin	Changes cane-sugar into grape-sugar.
	4. Milk-curdling	In small intestine (?).
Blood . . . . . Chyle . . . . Liver (?) . . . . Milk . . . . . Most tissues. . .	Diastasic ferments	
Muscle . . . . . Urine	Pepsin and other ferments .	
Blood	Fibrin-forming ferment . .	

Judging from the results of experiments made by Zagari, Straus, and Wurtz, who exposed various pathogenic organisms, among others that of tuberculosis, to the action of gastric juice, we must come to the conclusion that, so long as the gastric juice retains a sufficient degree of acidity, tuberculosis of the alimentary canal will be unlikely to occur.

Albumin and the Gastric Juice.—Another property of gastric juice in infants is the transformation of albumin in the following manner: (1)

albumose; (2) then peptone; (3) and lastly syntonin. It is thus apparent that, although the infantile stomach plays a subordinate rôle as a nourishing organ, it cannot be denied that fluid substances—like water, a solution of salt, and solution of sugar—are absorbed, and in a less degree albumin also. The relative size and capacity of the stomach prevent the function from being as thoroughly developed as in the adult.

STOMACH CAPACITY.

At birth the infant's stomach has a capacity of from 9 to 11 drachms, or 35 to 43 cubic centimeters. At the end of one month it is about 2 ounces, or 60 cubic centimeters.

At the end of three months the gastric capacity is about four times the amount at birth. The very rapid increase from birth to this time soon ceases, and the stomach capacity grows in size, but at a much slower rate of development (Baginsky).

The series of experiments at the Children's Hospital of St. Petersburg, made by Ssnitkin, showed that the weight, and not the age, determined the capacity of the stomach, and should be used as a guide for the quantity of infant-food required.

If the normal (initial) weight of an infant is 3000 to 4000 grams, or about 6.6 to 8.8 pounds, then $^1/_{100}$ part, plus the daily increase in weight added, which normally amounts to from $^2/_3$ to 1 ounce, would give the amount of food required.

Biedert also regards the body weight as an important factor in determining the amount of milk to be given. Baginsky argues that, while this rule will hold good for a great many infants, he must insist upon relying upon the *scales* to show just how much nutriment has been digested, and thus a regular system of weighing, plus the inspection of the stools, will aid in establishing the quantity of food necessary. "There is no unanimity among experienced clinical observers upon the subject of infant-feeding." The majority of clinicians the world over order cows' milk in varying dilutions. Some use the cereals—like wheat, barley, rice, and farina—to dilute and subdivide the curd. Other clinical observers—Budin and Variot, French observers—*advise giving infants, at birth, whole milk; that is, pure, undiluted cows' milk.*

The following illustrations will serve to show *the difference in the capacity of infants' stomachs at various ages, taken by the author at the morgue of Bellevue Hospital.*

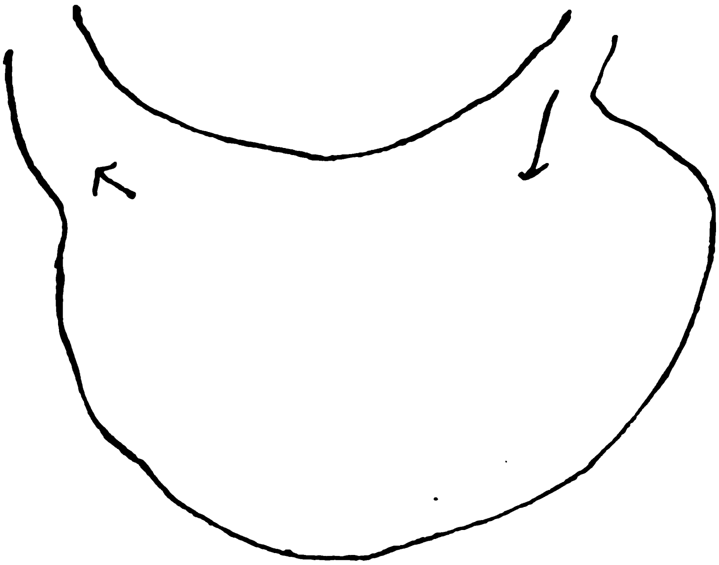


Fig. 62.—Infant's Stomach. Actual Size. From a Case of Malnutrition. Capacity, About 2 Ounces. When Stomach was Filled it Held 4 Ounces Easily. (Author's Collection.)

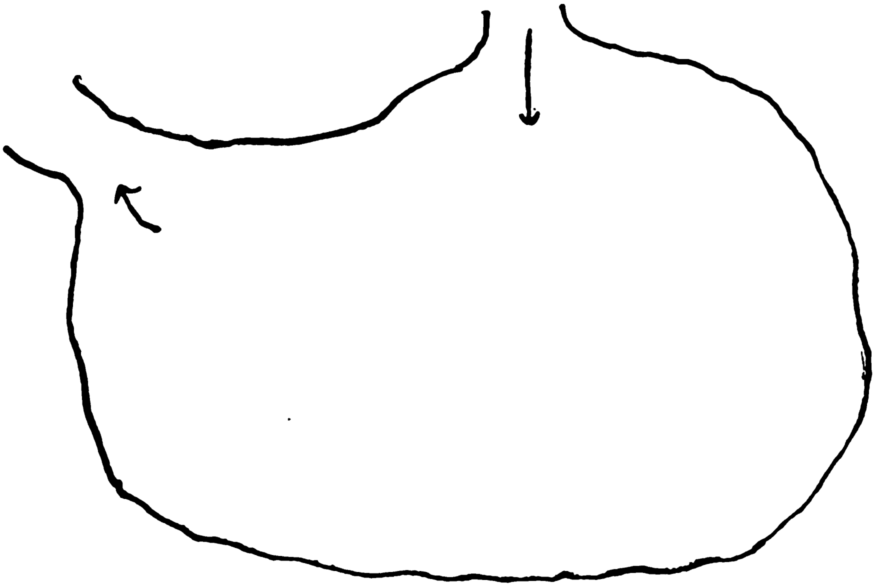


Fig. 63.—Infant's Stomach. Actual Size. Died Suddenly from Convulsions. Age Seven Months. Cause of Death, Eclampsia. Capacity when Filled with Water, 8¾ Ounces. (Drawn from Specimen in Author's Collection.)

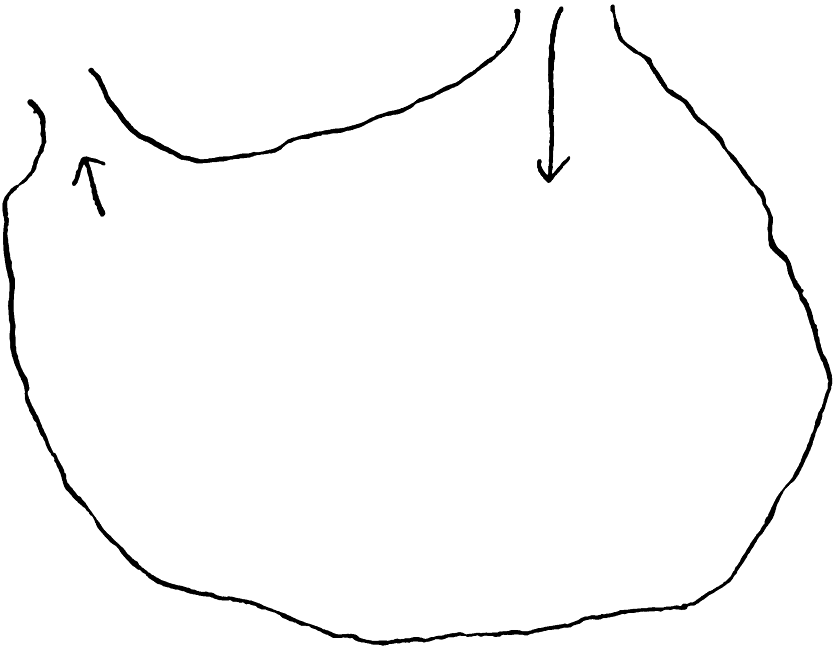


Fig. 64.—Infant's Stomach. Capacity, 10 Ounces. Age of Child, Eleven Months. Cause of Death, Enteritis. (Drawn from Specimen in Author's Collection.)

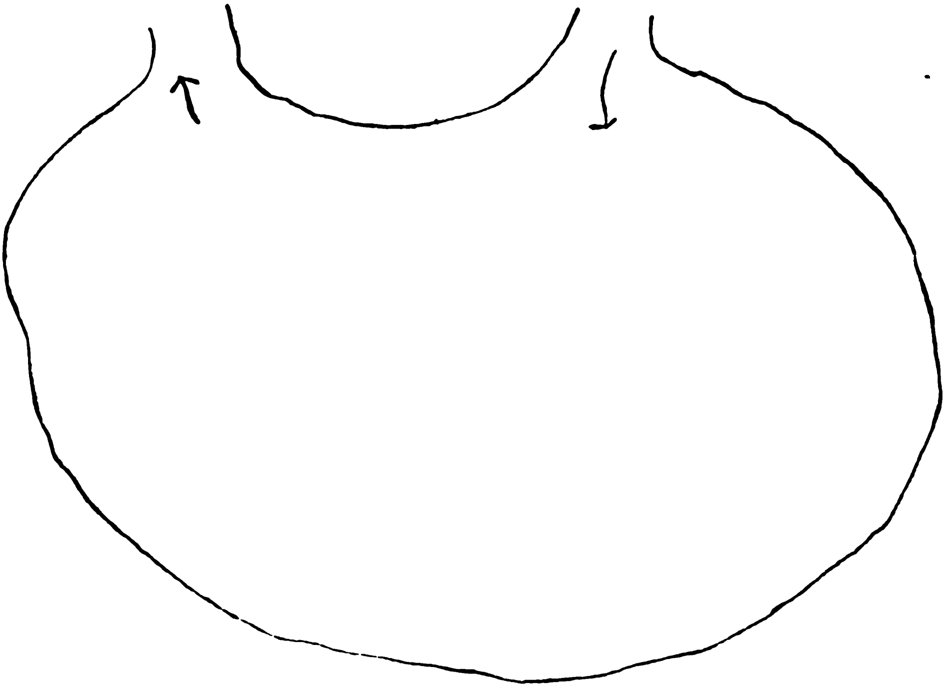


Fig. 65.—Capacity of Measurement, 14 Ounces. Diseased Condition. Normal Capacity, Holding About 2 Ounces, or 50 Cubic Centimeters. (Author's Collection.)

SIGNIFICANCE OF VOMITING.

Vomiting is a reflex act. It can be produced directly by irritating the stomach, as, for example, when mustard is swallowed. It can also be produced by a great many vegetable products, as, for example, by ipecac root. Mineral poisons, such as sulphate of zinc or turpeth mineral, or sulphate of copper, will produce violent emesis. Bacterial fermentation from stagnant food can also produce vomiting. These causes are therefore direct in their action and produce immediate results. It is a great mistake to look upon the stomach or the stomach contents as the etiological factor in vomiting, and as the only organ capable of producing emesis.

The toxins in the blood of many acute infectious diseases produce vomiting. One of the earliest symptoms of scarlet fever is vomiting. Several days before the eruption of scarlet fever appears, vomiting of a most violent nature generally occurs. This is no doubt due to toxæmia.

An irritation of the vagus or the pneumo-gastric nerves can result in vomiting. Any irritation brought about through the central nervous system will cause vomiting; thus it is that shock, fright, or disturbance of metabolism may produce vomiting of a most serious nature.

Giddiness, caused by swinging or a rolling motion, as on a ship, may produce cerebral hyperæmia, ending in vomiting. When a child falls on the back of its head and produces concussion of the brain, we have continued vomiting as a first symptom. When vomiting persists in spite of gastric treatment, meningeal disease should be suspected. In meningitis, especially in hydrocephalus, vomiting is a frequent symptom. The writer does not presume that any physician will diagnose brain fever, scarlet fever, or gastric fever by the single symptom of vomiting.

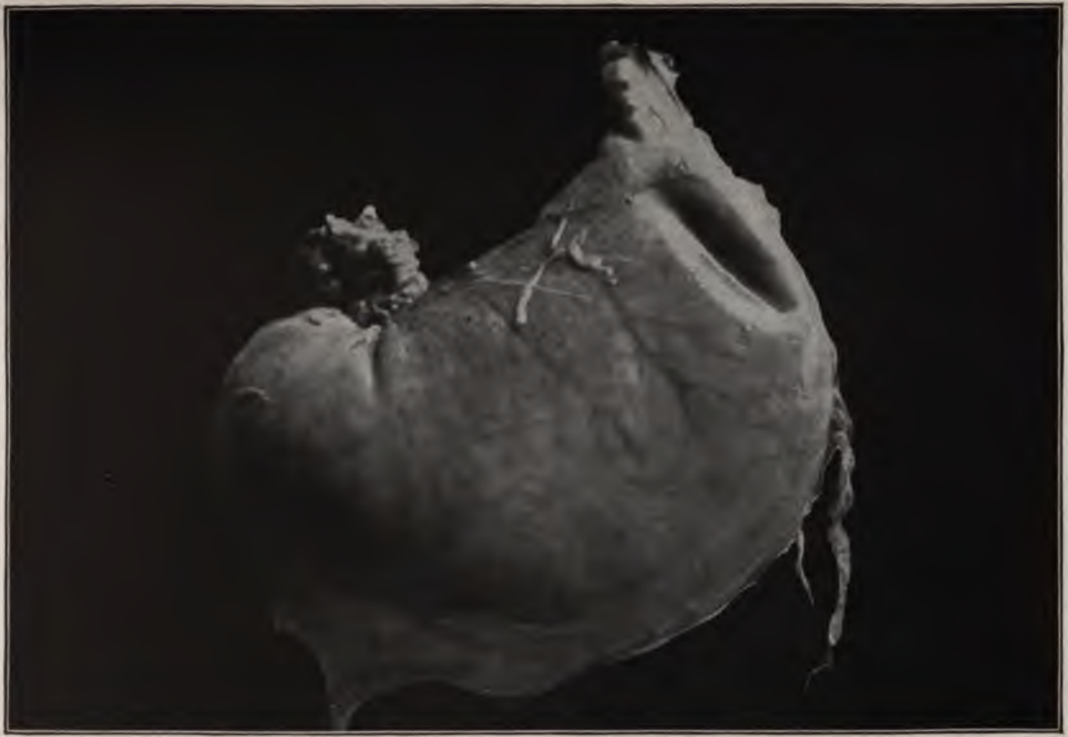
On the other hand, it is well to know that vomiting, with a suspicious rash and a sore throat, will strengthen the suspicion of an existing scarlet fever. A rule followed by the writer is to lay considerable stress on vomiting. It means nothing if we are dealing with a spoiled stomach following a large dish of plum pudding. But woe to the physician who gives a good prognosis where vomiting is an early manifestation of intracranial disease that ends fatally.

ACUTE GASTRIC CATARRH (DYSPEPSIA—GASTRITIS).

One of the most frequent diseases met with in infants or young children is dyspepsia. This is due to improper feeding of both quality and quantity of the food. Nursing children are very often seen suffering with this disease, especially among the tenement population.

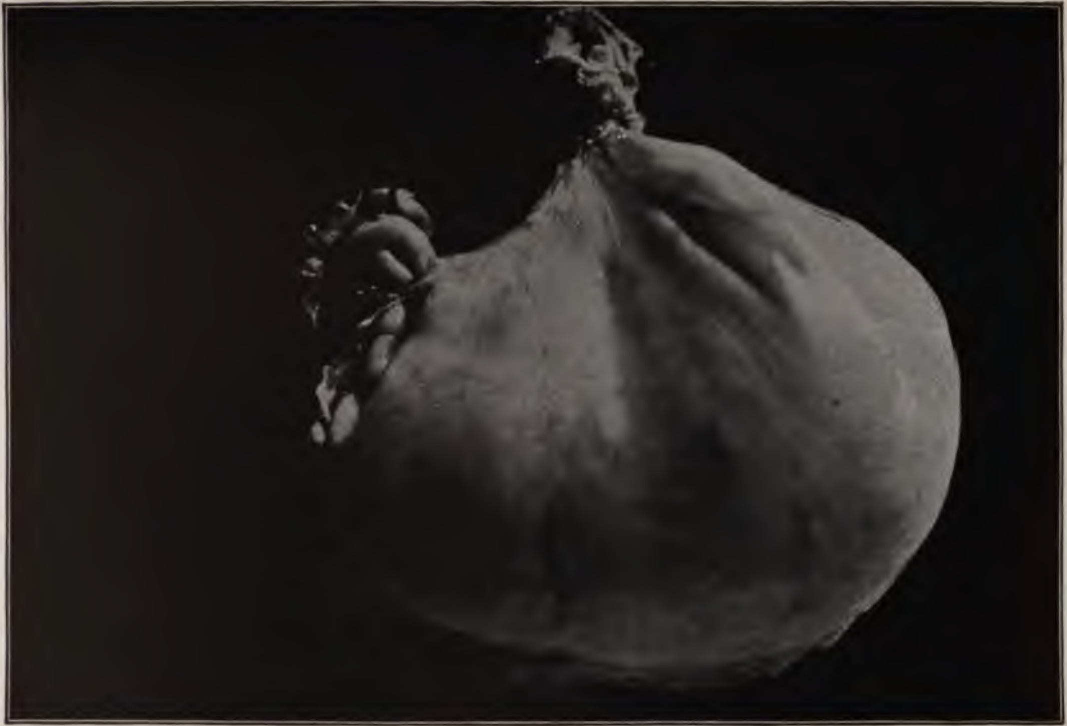
That the immediate surroundings, so-called poor hygiene, has some bearing on the development of this disease is certain. Children reared in unsanitary apartments cannot digest breast-milk as well as children living

PLATE IX



Infant's Stomach. One month old. Cause of death, malnutrition. (Original.)

PLATE X



Infant's Stomach. Actual size. Age, seven months. Cause of death, eclampsia, convulsions. Capacity, $8\,^{3}/_{4}$ ounces. (Original.)

in large airy rooms, with good hygienic surroundings; thus it is wise to study the origin of this disease before commencing any specific treatment.

The largest number of cases are seen with bottle-fed babies. It is here that the physician will be called upon to exercise the greatest amount of judgment. Errors in feeding, particularly over-feeding, and giving the infant the bottle whenever it cries, must be looked upon as a means of aggravating and exciting gastritis, if not being the real cause of the dyspepsia.

Pathology.—The mucous membrane of the stomach is always swollen and thickened. Occasionally erosions and hæmorrhages are found. The tissue beneath the mucous membrane, the submucosa, will be found œdematous. The interstitial tissue is infiltrated with leucocytes and the differentiation between the parietal and principal cells cannot be clearly outlined. All the cells appear cloudy and granular and partially separated from the membrana propria of the gland. There is an abundance of the mucous cells in the pyloric region, and this increase extends deeply into the ducts of the glands.

When gastritis is met with in older children the origin of the trouble can easily be traced. Over-eating, especially cakes and pies and puddings; too rapid chewing and swallowing of unmasticated pieces will aggravate an attack of this kind.

Gastritis is seen more often in older children who are permitted to drink wine or beer at the table with their parents. It is quite common to have, especially among the working classes, distinct evidences of alcoholic gastritis. Children are permitted to take a drop of whisky or wine or beer, as their parents say, "to strengthen them."

In a large dispensary service with which the writer has been associated for the past fifteen years, among a large foreign and native-born element, it was found by careful questioning that more than 50 per cent. of the children brought to this service were permitted to use stimulants.

Unwholesome feeding, candies, and ice creams have frequently caused acute gastritis in many children.

Symptoms.—A young infant will suddenly refuse to take its bottle and will appear very peevish and thirsty, flex its legs on its abdomen, will seem dissatisfied, and refuse to play. Vomiting is a frequent symptom. The infant will cry and put its fingers in its mouth. The temperature on the first day ranges between 102° and 103° F., though it may reach as high as 105° F. in the rectum. The pulse ranges between 140 and 160. The respiration is sometimes accelerated. The tongue is usually coated with a white or a grayish-white fur, and there is a fœtid odor to the breath. Diarrhœa may be present, although constipation is more frequently met with.

When children are extremely anæmic, or if from previous malnutrition they are rachitic, the disease will commence with convulsions. Convulsions must not be looked upon as very serious unless they recur several times during the first day of the attack.

A diagnosis of meningitis will frequently be made in the commencement of an acute catarrhal gastritis, unless we study the pulse-rate. In meningitis the pulse-rate is usually slow, in gastritis it is greatly accelerated. Pressure on the epigastrium will show marked tenderness. The stomach is usually distended and tympanitic on percussion.

If a child is old enough to complain, there are usually subjective symptoms such as headache, frontal in character, and pains in the arms and legs will be described. Jaundice will usually be found in older children in the course of the disease, and denotes an extension of the catarrhal inflammation from the stomach into the duodenum, thus gastro-duodenitis may be diagnosed when jaundice is established.

Prognosis and Course.—The prognosis of an acute catarrhal gastritis depends on the time of the year and the condition of the child at the time of the attack. If a bottle-fed infant is attacked with gastritis in midsummer, and it cannot be removed from the sultry city, then the prognosis is grave. If, however, breast-milk can be given judiciously and the feeding interval conform with the requirements of the weak digestive apparatus, then we may reasonably hope for a favorable termination. If complications occur, chief among which may be typhoid fever, or an extension of the disease from the stomach into the bowel, then the outlook will not be good, unless we can remove the patient to the mountains or seashore.

Nephritis frequently complicates gastritis, and when such complications exist the prognosis is bad. Infectious diseases complicating gastritis will render the prognosis unfavorable.

The important point to note is, how much food is being assimilated. If the infant digests a proper quantity of food the prognosis is good; if, however, vomiting continues and we cannot feed the child per mouth or per rectum, then the prognosis is very grave. We must aim to prevent starvation if the child's life is to be saved.

Treatment.—The first thing to do is to cleanse the stomach. This can be accomplished by giving a dose of castor-oil, syrup of rhubarb, or calomel. If the child is old enough some citrate of magnesia in wineglassful doses, repeated every two or three hours, will correct fermentation. When rapid cleansing of the stomach is demanded, owing to toxic symptoms from ptomaine poisoning or from other poisons, an emetic should be given. A dose of 1 grain of sulphate of copper in a teaspoonful of water, repeated every half-hour until vomiting is produced, will materially aid in cleansing the stomach. Syrup of ipecac, in teaspoonful doses, may also be given in some instances, although the writer does not advocate the use of syrups in acute fermentative diseases of the stomach or bowels. In other cases washing the stomach with a soft catheter, as mentioned in the treatment

PLATE XII

(Original.)

Fig. I.

Baby P., one year old, was seen at the children's service of the German Poliklinik during the summer months. She had fever, anorexia, and intense thirst. Vomiting was present; the bowels were loose and contained mucus and curds. The diagnosis of acute dyspepsia was made. *The gastric content, in which these large curds were found, was syphoned off three hours after feeding.* It was evident that the infant could not digest whole milk. Equal parts of milk and rice-water was ordered. A cleansing dose of castor-oil was given.

Fig. I.

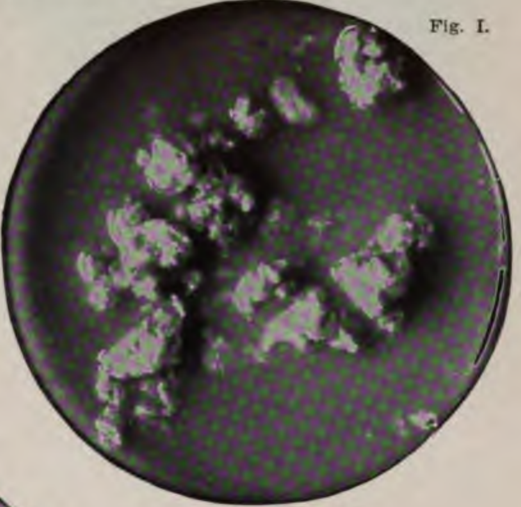


Fig. II.

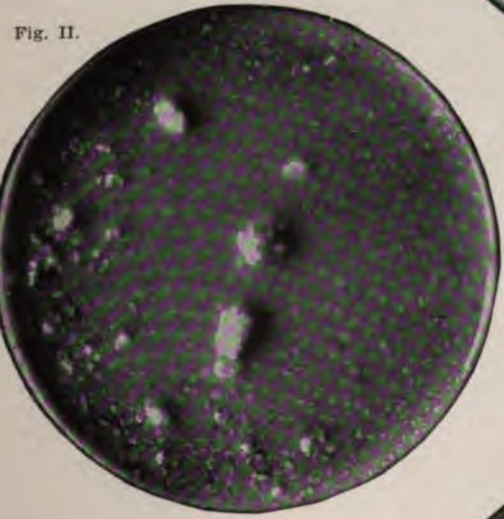


Fig. II.

Two days later the infant was again seen. The symptoms were greatly improved. The vomiting was stopped. The fever was less. *Stomach-washing was again resorted to three hours after the last food was taken.* A pint of warm water, to which a teaspoonful of salt had been added, was used. As the curd was but partially digested in this dilution of food, I decided to add an infant food, to produce mechanical breaking up of the curd.

Fig. III.

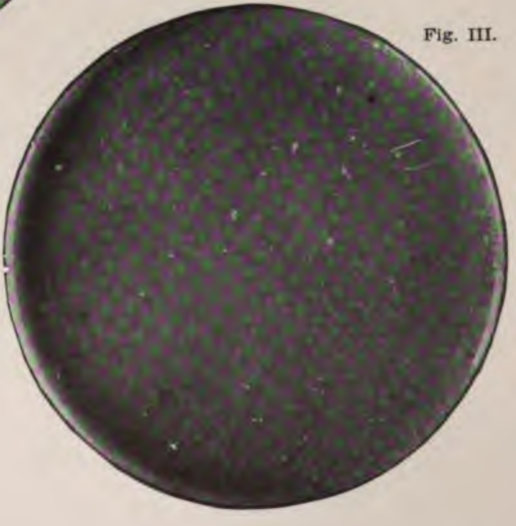


Fig. III.

Gastric contents of the same infant syphoned off three hours after feeding with equal parts of milk and water modified by the addition of four teaspoonfuls of Eskay's Food. The character and size of the curd are worth noting. It illustrates the mechanical effect produced by the food in breaking up the curd.

of summer complaint, will prove very valuable. Several pints of table salt solution or of normal salt solution[1] can be used to thoroughly cleanse the stomach until the water is syphoned off quite clear. In washing the stomach with the aid of a soft rubber catheter there is usually quite some irritation produced in the pharynx and œsophagus, and thus vomiting will usually aid in the lavage in clearing the stomach of its contents. When such treatment has been instituted it is advisable to allow the stomach to rest at least six or seven hours, and meanwhile give sterile water—"ordinary boiled water"—*ad libitum.*

When the bowels have been properly cleansed and the stomach has been washed by lavage, or treated with one of the above-mentioned laxatives, then the after-treatment will consist in preventing further fermentation and also in toning up the patient's condition.

Medicinal Treatment.—Experiments have shown that when the gastric contents have been syphoned off or examined immediately after an emetic has been given, in an acute gastritis, that there is a deficiency of hydrochloric acid. This is an indication then as to what is required.

Diluted hydrochloric acid given in doses of from 2 to 5 drops has served the writer very well when given every three or four hours.

℞ Acid hydrochloric dilut	1 drachm
Essence pepsin (Fairchild.)	2 ounces

M. D. S. Teaspoonful repeated every two or three hours.

Beta-naphthol bismuth in doses of 1 to 5 grains, every two hours, has served me very well. Calcined magnesia[2] is also very valuable. The following prescription has been used with very good results in dyspeptic conditions attended with constipation:—

℞ Magnesia usta	1 drachm
Pulv. rhei	1 drachm
Saccharine	2 grains

M. and divide into 12 powders. One powder to be given in a teaspoonful of sterile water every two or three hours.

Powdered charcoal added to the above prescription in doses of 1 grain three times a day, is frequently useful. Salol in doses of 1 grain every two or three hours, and resorcin in doses of $^1/_{10}$ grain or $^1/_4$ grain, for a child 1 year old, repeated three times a day, will do good in some instances.

A very good liquid preparation sold in drug stores is milk of magnesia (Phillip's). It is an excellent antacid and corrective when flatulence exists.

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[1] Formulæ for saline solutions will be found in the chapter on "Scarlet Fever."

[2] Magnesia in powdered form I frequently use is known as Husband's Magnesia in drug stores.

When severe thirst exists boiled water may be given. This water may be acidulated with a few drops of diluted phosphoric acid, and will be found not only very grateful and cooling, but very serviceable if the child has a tendency to diarrhœa in midsummer.

Dietetic Treatment.—The most important point to remember is the feeding. If we are dealing with the nursling, then breast-milk should be withheld for about one-half day. When the breast is given again, the infant should not be permitted to nurse more than two or three minutes, and immediately after taking the breast the infant should receive 3 or 4 ounces of sweetened rice water. In this manner we will give the infant diluted milk. This breast and rice water feeding should be repeated in four hours, no sooner, no matter what the age of the infant.

What might appear very radical is simply advised, to prevent the stomach from performing its usual amount of work until the gastric function is reëstablished. If, however, the child's appetite warrants it, then one or two days should elapse before giving it its former regular quantity of nursing. The guide to the return of the normal quantity of nursing will be the disappearance of the fever and of the accelerated pulse-rate. The child's craving for the breast can be noted chiefly by constant crying when the breast is removed, and the ravenous manner in which it nurses.

In bottle-fed babies it is advisable to give the child one-half of the former quantity of milk or cream which it received at the time of its illness, and if it is found that the sugar contained in the food aggravates this condition, a small quantity of saccharine may be used to sweeten the milk, and the sugar discontinued. Some children show distinct fermentative changes after the use of too much sugar. In such cases the use of saccharine or one-half teaspoonful of glycerine to each bottle of milk is sometimes beneficial as a temporary substitute.

Glycerine is absolutely harmless and may be given for months with impunity. My rule is to insist on the use of sugar if at all possible. Lime water in doses of a teaspoonful or a tablespoonful may be added to the milk. Five grains of bicarbonate of soda may be added to the milk or given before each feeding. If vomiting follows the milk-feeding, whey should be substituted.

Attention must be paid to the quality of milk given to infants. There are many dairies in New York City which furnish an excellent quality of milk, owing to the great care bestowed upon the milk supply by the Health Department, and also by the Milk Commission.

If milk seems to aggravate an attack of dyspepsia, then zoolak or kumyss or other fermented milk may be tried. Buttermilk is very nourishing and very useful in dyspepsia. Junket may also be tried, so also can whey be given several times a day. Soups and broths, calf's foot and chicken jellies are all nourishing. Steak juice and unfermented grape juice will be servicable. Boiled fruits, such as apples and peaches, if the child is old enough and the condition warrants it, may be tried.

Our aim must be to have the infant fed with a large interval of rest, so that nausea and vomiting may be prevented, and in order that the food may be properly assimilated. We must therefore give small quantities with large feeding intervals. When the functions are again normal then we can return to a judicious, nutritious diet, as demanded by the infantile stomach. It is advisable to give nux vomica in doses of 1 minim for a child, 1 to 3 years old, three times a day before feeding, and to continue the same for months after the gastritis disappears. The writer has seen the most marked improvement following the use of this drug, and regards it as a specific for toning the stomach.

Malt extract should be given in doses of a half teaspoonful, three times a day, to aid nutrition. It is well known that malt has a dĕcided laxative effect. Care should be taken that fermentation is not reëstablished while giving malt. In some cases it is not well borne in the commencement of an acute gastritis, and a total abstinence of milk and the substitution of boiled water, whey, soups, and broths may become necessary; very weak tea, to which the white of a raw egg has been added and sweetened with saccharine or with granulated sugar, can be given with advantage.

Fever.—The temperature in the course of an acute gastritis requires no antipyretic treatment, although sponging the surface or a cold pack, applied over the thorax and abdomen, will be servicable. Specific fever treatment is uncalled for. The well-known depressing effect of antipyretic drugs must not be forgotten, and hence the specific cause of the disease must be removed. This is usually stagnant food. The same requires cleaning out with calomel or cascara. The cause of the fever will be removed with such effectual treatment.

When children have a tendency to convulsions then a mustard foot-bath can be given and an ice-bag applied over the anterior fontanel, or at the nape of the neck. In such instances the most rapid treatment will be called for, such as washing the stomach with a catheter, using warm salt water. An emetic will prove useful in those cases where lavage cannot be successfully carried out.

Alcoholic stimulation is contraindicated in every form of gastric fever. The writer has always seen bad results follow the use of whisky when the gastric mucous membrane was inflamed. If, however, the patient is threatened with collapse, or the pulse is very weak, then small doses of musk in the form of a tincture of musk can be injected hypodermically, every hour, until the pulse-rate improves. Camphorated oil, injected hypodermically, in doses of from 5 to 15 minims, may do good in some cases.

Whisky in doses of 5 to 15 minims, hypodermically, should be used when the heart sounds are feeble and the pulse is thready. If violent vomiting continues champagne can be given per mouth, and if symptoms of collapse appear, very cold champagne in doses of a teaspoonful, repeated every half-hour, until proper effects are obtained.

Convalescence will depend on the condition of the patient after the attack, and it is advisable to remove the child in the summer to the seashore or mountain while recuperating. If an attack appears in winter and the child's vitality is subnormal, then a change to a milder climate in the South or in the West, from the city to the country, or from the country to the city, will frequently restore normal functions. Judicious feeding will, however, be the most potent factor in the future development of the child.

SPASM OF THE PYLORUS (SPASMODIC STENOSIS.)

This condition is obscure. Some clinicians describe congenital stenosis due to a hypertrophy of the pylorus.[1]

Pfaundler, who has studied this subject most accurately, believes that the symptoms described as congenital hypertrophic stenosis are more apparent than real. He attributes the stenosis to a spasm of the pyloric sphincter. An important point bearing on the possible congenital origin of this trouble is the fact that the symptoms usually commence soon after birth, hence the presumption of a congenital origin of this trouble seems plausible.

Pritchard has reported 24 cases where the vomiting began at birth or between the first and seventh days.

Symptoms and Diagnosis.—Persistent vomiting usually during the first few days after birth or as late as the fifth week, as reported by Finkelstein,[2] is one of the earliest symptoms.

The quantity of food expelled is sometimes far greater than the quantity swallowed during the last nursing from the breast or bottle. This is evidently due to retention of the previous meal, and has an important bearing on the diagnosis of stenosis.

There is no milk residue in the stool, simply a mucous or gelatinous (green-bilious) stool, which excludes obstruction below the duodenum. These symptoms continue until there is a sudden stoppage of the vomiting. With the disappearance of the vomiting digested milk can be noticed in the stools. In some cases a tumor can be palpated at the region of the pylorus. There may also be dilatation of the stomach with visible peristaltic movements. In some instances emaciation due to inanition will be noted. The temperature of the child is not affected. For treatment, read article on Hypertrophic Pyloric Stenosis.

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[1] Southworth, Archives of Pediatrics, January, 1901.

[2] Jahr. f. Kinderh., vol. xviii, p. 105.

HYPERTROPHIC PYLORIC STENOSIS.

This condition is not so rare in infancy as is commonly supposed. While in 1902 Cautley and Dent reported 109 cases, we have since then over 150 cases recorded in medical literature.

In our own country, Pritchard's, Saunder's, West's, Dorning's, Meltzer's, and my own case have been reported. In these cases an operation for the relief of the stenosis or a post-mortem proved the correctness of the diagnosis.

Etiology.—Stenosis may occur as a congenital malformation. Hyperacidity is believed to be responsible for some cases of spasm of the pylorus resulting in hypertrophy. Thomson believes that by the ingestion of liquor amnii in intra-uterine life both the stomach and pylorus are excited to overaction, due to the presence of this irritant fluid.

Morbid Anatomy.—Under normal conditions the circular muscle fibers of the pylorus at birth are relatively augmented, gradually approaching the normal as the long axis of the stomach assumes its horizontal direction from the vertical; this relative augmentation of the circular fibers is intended to prevent the too rapid emptying of the vertical tubular infantile stomach during the first two weeks of life. These fibers, stimulated to excessive function by any given cause, must, according to recognized physiological principles, become hypertrophied.

Accepting such a working basis, we should recognize in hypertrophic pyloric stenosis the ultimate results of a pathological process whose first stage is represented by an excessive functional activity of the pyloric musculature; its second stage by hypertrophy and spasm of this musculature, and the third stage by a general overgrowth of the normal constituents of the involved parts.

Symptoms.—Soon after birth, or within a few weeks, there is a sudden onset of symptoms. The food will suddenly disagree and the infant will vomit. Vomiting will continue whether the infant is nursed at the human breast or artificially fed. The vomiting is regurgitant; at times, however, markedly explosive. The quantity vomited ranges from a teaspoonful to many ounces. Bile is seldom mixed with the vomit. As a rule, the vomiting has a very sour smell, resembling butyric acid. Large strings of mucus of a glairy character and sometimes cheesy curds are found in the vomit.

Owing to the stenosis of the pylorus, no food passes into the duodenum, hence the stool will be found to contain no particles of milk fæces. If there is any stool, it consists of a mucus mass, usually greenish in color.

There are active peristaltic and antiperistaltic waves visible. This is most marked after the infant has swallowed food or water. In a case reported by me[1] very strong peristaltic waves could be noticed from left to right. There was a distinct hourglass contraction, the stomach bulging on either side with a sulcus in the middle. The abdominal walls are lax. The intestinal wall, chiefly the transverse colon, can be easily mapped out.

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[1] Archives of Pediatrics, May, 1906.

On palpating the pylorus in my own case, a hard, resisting mass, about the size of an adult's thumb could be felt. Gradual emaciation from inanition will be noted.

Stagnation of the gastric contents is proven by the fact that while two ounces of the food is swallowed, six or eight ounces is frequently regurgitated and vomited. The quantity of urine is also scant, owing to the small quantity of liquid and food absorbed. A whole day will frequently pass without a single diaper being wet.

The examination of the gastric contents shows great variability. In my own case, the presence of lactic acid and the total absence of hydrochloric acid was noted. Other observers have noted an excess of hydrochloric acid.

Prognosis.—If the vomiting persists, death will occur from exhaustion. In a case seen by me, where operation was refused, the infant died of inanition after three weeks.

Treatment.—Dilute the food to half-strength. If a milk mixture containing 2 per cent. of fat has been given, then 1 per cent. of fat should be tried.

There should be a longer interval between the feedings. If a baby has been fed every two hours, it should be fed once in three hours. If two ounces had been given at one feeding, then one ounce should be tried. If, after this method, vomiting persists, then the stomach should be allowed to rest at least twenty-four hours, during which time rectal feeding can be tried. Stomach-washing every morning with normal saline solution may do good in some cases.

On the theory that hyperacidity was the cause of pyloric spasm, Knoepfelmacher used whole milk feedings in order to modify the hyperacidity. Bromide of sodium, codeine, menthol, or subnitrate of bismuth may be tried.

Surgical Treatment.—If, after a patient trial of the above-outlined plan, the condition does not improve, then surgical relief is indicated. In this stenotic stage, gastro-duodenostomy in two sittings, if necessary, should be the operation of choice.

"At the first of these, slight fixation of the involved parts to the abdominal incision, opening of the duodenum, and the insertion of a temporary catheter for purposes of direct feeding.

"After a proper interval, depending upon the patient's gain in nutrition and strength, an anastomosis between this opening in the duodenum and the stomach, either by the small button of Meyer or a modification of the Finney operation." (Sturmdorf.)

Post-operative Treatment.—Strychnine, $^1/_{150}$ grain hypodermically every three hours, is required. Normal saline injections, either by high colonic flushing, or, if the pulse is weak, by means of hypodermoclysis.

By mouth, several teaspoonfuls of whey every hour. This method is ample for the first few days, after which special feeding rules may be indicated.

GASTRO-DUODENITIS (CATARRHAL JAUNDICE).

When the infection of an acute catarrhal gastritis extends into the duodenum, jaundice usually results. This is due to an involvement of the common bile ducts.

Symptoms and Diagnosis.—Yellowish pigmentation of the skin and conjunctival mucous membrane are noted. The urine is brown or deep yellow. The stool is whitish or clay-colored. The temperature ranges between 100° and 103° F. Anorexia and thirst usually exist. Nausea or vomiting may occur. The pulse is full and regular. The liver is usually enlarged.

Treatment.—Elaterine or podophyllin in ¼ grain doses, repeated, if necessary, in three hours, or phosphate of soda, 10 to 20 grain doses every three hours, until liquid stools are produced. Dilute nitro-muriatic acid, 2 to 5 drops may be given twice a day. Liquid food, such as thin soups, diluted milk or skim-milk or buttermilk, and fruit juices, for thirst.

CHRONIC GASTRITIS (CHRONIC GLANDULAR GASTRITIS—CHRONIC VOMITING).

This is a chronic inflammatory disease affecting the gastric mucous membrane. The functions of the stomach are disturbed owing to the large quantities of alkaline mucus being secreted. There is a distinct loss of tone in the gastric mucosa. Large quantities of food will frequently stagnate, causing fermentation and vomiting.

Pathology.—The changes in chronic gastritis, seen post-mortem, are similar to those met with in the acute form. There is a degeneration of the epithelium of the gastric tubules. Frequently there is dilatation of the stomach.

Microscopically the glands often seem enlarged, sacculated, and dilated in cyst-like forms. Ewald states that there is a mucoid degeneration. When there is a total destruction of the glandular layer of the entire organ, we have an atrophic condition which Ewald calls anadenia ventriculi.

Symptoms.—Vomiting is a prominent symptom. Large quantities of sour or bile-stained mucus are ejected. At other times sour-smelling liquid containing particles of food is ejected. Farinaceous foods cause particular distress. Pains referred to the abdomen are complained of, and the abdomen is usually distended and tender on palpation. The tongue is coated.

The papillæ are enlarged and the edges and tip are of a bright glazed red. Eructations of gas are frequently noted, especially after feeding.

The Bowels.—Constipation alternates with diarrhœa in this condition. We find a child will suffer with constipation for three or four days, and for no apparent reason a diarrhœa will appear and continue for a week or more. Eczema is usually associated with this condition. There is usually anorexia. Owing to the malnutrition such children appear underfed and seem to be anæmic. They emaciate from loss of sleep in addition to the continued vomiting. Their extremities are usually cold, owing to a poor circulation. Headache is a prominent symptom in children old enough to complain. The clinical picture is such that one must take extreme care to make a proper diagnosis. Frequently there is a hacking cough present. We may exclude tuberculosis if the pulmonary signs are wanting in addition to the absence of the tubercle bacillus.

Diagnosis.—The diagnosis is easily made if we remember that tuberculosis has fever which at times assumes a hectic form. We have previously mentioned the necessity of finding the tubercle bacillus if tuberculosis is suspected. Typhoid fever is so different that we can easily exclude this by resorting to the Widal and diazo reactions. Syphilis, if suspected, will respond to specific treatment.

Prognosis and Course.—This condition should be looked upon as every other chronic disease in which vitality, surroundings, and proper care play an important part. If a child of a poor family living in a tenement house suffers with this chronic disease, the outcome will be different than if the child were living in the country where fresh air could and would stimulate metabolism. Rarely is this condition fatal, although with extreme emaciation and continued vomiting inanition may cause death.

Treatment.—*Dietetic Treatment:* This is the most important factor. The feeding interval should be extended so that the child should be fed less often than formerly. The quantity of food should be reduced so that the stomach receives less work. By all means give food that is easily assimilated. In some cases nothing but predigested food or peptonized milk will be retained. Each child should receive a carefully prepared diet list, and we must insist on strict rules. Give older children soups, broths, albumin, such as white of egg, and peptonized yolk of egg. Give infants diluted milk or one of the infant foods temporarily. When vomiting persists and apparently little or no food is retained, it is advisable to put the child to bed and resort to rectal feeding for two or three days. This is one of the best means of allaying gastric irritability. (See chapter on "Rectal Feeding.")

Hygiene.—Without fresh air, active exercise, such as walking, or passive movements, such as massage or gymnastics, we must expect little or no benefit. Daily sponging or bathing, followed by friction with a coarse towel, will stimulate the circulation.

Medication.—Stomach washing, by using 1 or 2 pints of warm water to which bicarbonate of soda has been added, is very useful. This may be repeated every day. Sodium phosphate, in 5 to 10-grain doses, every morning or evening, is indicated.

Fowler's solution, in 1 to 5-drop doses, three times a day, and nux vomica, in 1-minim doses, three times a day.[1]

Bismuth subnitrate or bismuth beta-naphthol to relieve the diarrhœa, are very valuable remedies.

For persistent vomiting menthol in 1-grain doses, and oxalate of cerium, in 2 or 3-grain doses, every few hours, is useful. Gentle currents of faradic electricity will also aid and strengthen the atonic condition.

ACUTE DILATATION OF THE STOMACH.

This condition is quite frequently met with in children.

Etiology.—The anatomical and physiological peculiarities of the infantile stomach render it peculiarly susceptible to the development of this

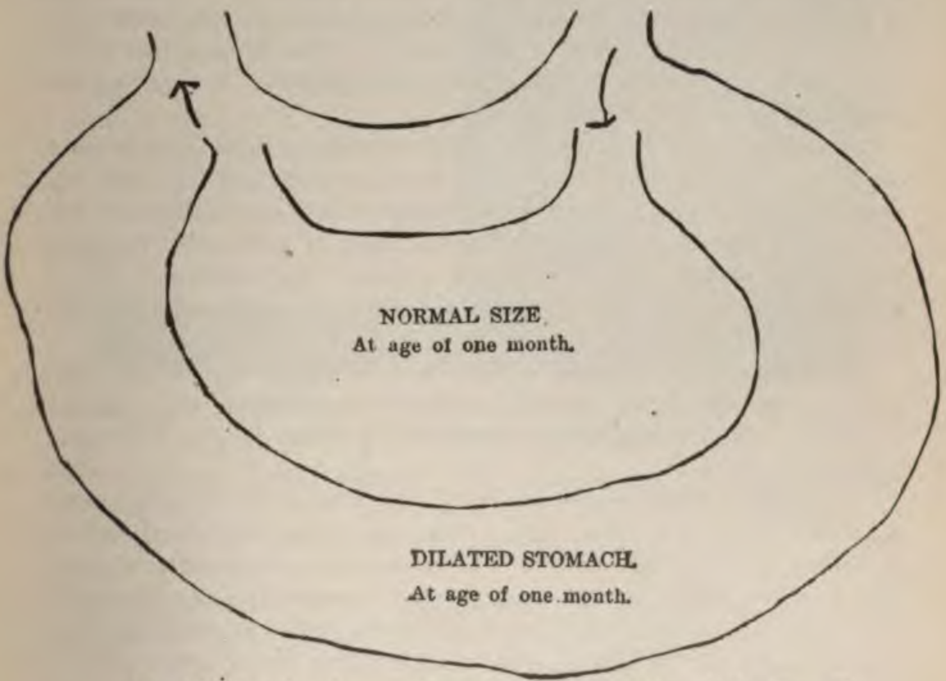

Fig. 66.—Drawing from a Case of Acute Dilatation of the Stomach, Giving Exact Size Post-mortem. Bottle-fed Infant. Summer Complaint, Due to Over-feeding, and Too Frequent Feeding. Compare normal size with the dilated condition. (Original.)

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[1] Fraser, of New York City, makes a 1-minim nux vomica tablet, which is soluble and quite palatable.

condition. The walls of the stomach are thin. The weakness of the resistance of the muscular walls and the ease with which a general anæmia and resultant muscular atony occurs in children must be remembered in considering etiological factors. Rachitis plays an important part in the development of this condition. Severe gastric catarrh with associated fermentative conditions are predisposing factors.

Pathology.—A general atrophied condition of the entire gastric wall exists. The muscular coats are frequently thickened. The mucous membrane shows evidences of chronic catarrh. This condition is usually seen in marasmic or rachitic children. The stomach is invariably dilated.

The symptoms of this condition correspond to those of chronic gastric catarrh. In standing the child upright the contour of the greater curvature of the stomach can be made out if emaciation exists. Vomiting is a prominent symptom, a sour, frothy liquid being thrown up. Succussion is frequently heard, but cannot be depended on as a positive symptom in this condition. Children suffering with acute dilatation usually have a very good appetite. They always show evidences of malnutrition. The results of percussion are very misleading. A tympanitic sound may be heard when the child is on its back. It may also be absent. Henoch states that severe dilatation of the stomach in a child may cause dyspnœa. It may also displace the heart if dilatation is severe.

Diagnosis.—The diagnosis can usually be made by the symptoms above described. It is important to remember that a dilatation of the colon may exist at the same time; if so the differentiation between dilatation of the colon and dilatation of the stomach can be made by artificially distending the stomach with the aid of a Seidlitz powder. Translumination of the stomach with the aid of a gastrodiaphane will aid in mapping out the anatomical outlines of the stomach.

Prognosis.—This depends on the condition of the child when treatment is commenced. If the child is physically debilitated and does not assimilate food, the prognosis is grave. It is safest to give a cautious prognosis in every case.

Treatment.—Semi-solid foods should be given, if possible, and large quantities of liquids avoided. The normal tone of the stomach can best be restored by the administration of nux vomica and iron in suitable doses. The value of electricity and massage must be remembered. They will restore the tone of the stomach when judiciously used. Specific conditions such as rickets and syphilis, if present, require their proper treatment.

Bulimia (Abnormal Appetite).

Constant desire to eat is frequently seen when intestinal parasites, such as tapeworm, are present. It is also found as a symptom of hysteria.

A. B., 7 years old, desired five and six meals a day. Her body was emaciated and occasional abdominal pains were described. The mother attributed the pains to overeating. After several doses of filix mas a tapeworm was dislodged (see treatment in the chapter on "Tapeworm") and the bulimia disappeared.

GASTROPTOSIS (DESCENSUS VENTRICULI), LOW POSITION OF THE STOMACH.

We are indebted to Glenard[1] for emphasizing sufficiently the clinical symptoms due to this condition.

Etiology.—In subnormal conditions such as chlorosis or where a general atony exists, a weakening of the ligaments takes place and the abdominal viscera consequently descends. Very tight lacing is frequently a cause in young girls.

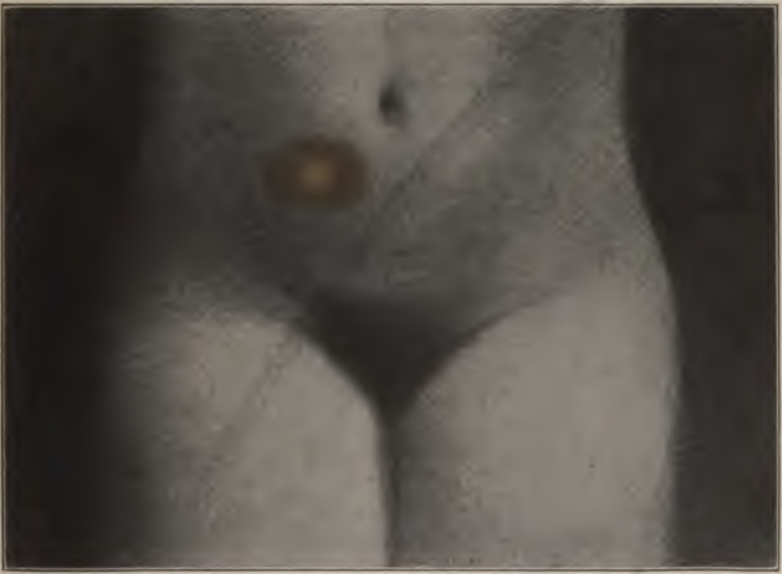

Fig. 67.—Translumination of the Stomach with the aid of a Gastrodiaphane, in a case of Gastroptosis. (Original.)

In a series of autopsies made by Glenard he found the transverse colon displaced and stenosed.[2]

Symptoms.—A variety of nervous symptoms such as irritability, headache, restlessness by day and insomnia by night, is frequently due to this disorder. The symptoms which characterize nervous dyspepsia in the adult correspond with the train of symptoms noted in this condition. Constipation is usually present; there is loss of appetite and eructations.

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[1] Lyon Medicale, 1885, p. 450.

[2] Einhorn: "Diseases of the Stomach." First Edition, p. 368.

Diagnosis.—Ewald advises inflation of the stomach as the best means of diagnosis. "When the stomach is inflated the lesser curvature, in cases of gastroptosis, is visible midway between the ensiform process and the navel, or just in the neighborhood of the umbilicus." With the aid of the gastrodiaphane we can transluminate the stomach and make out the contour of the same. This has been found a valuable means of diagnosis. The red illuminated area can be plainly made out if the room is darkened. The following case illustrates this condition as met with in practice:—

Rosie B. was first seen by me when 13 years old.

Family History.—Father and mother living and well. She has six sisters and one brother living, all in good health. There is no family history of syphilis, rheumatism or tuberculosis. One child of 3 years died from pneumonia complicating measles.

Personal History.—She was a breast-fed child and appeared to be well developed. She has had measles and with it bronchitis. Menstruation appeared when she was 13 years old and lasted seven days. She has complained for the last two years of headaches, pains in the back and abdomen, loss of appetite, and does not sleep well. She is very nervous and has had a peculiar unilateral twitching involving the right arm and shoulder. This twitching appears spasmodically and is exaggerated when her attention is directed to it. She complains of cold extremities, and has an occasional cough. No expectoration. The cough appears to be of the same character as that seen in adults which is described as a hysterical cough.

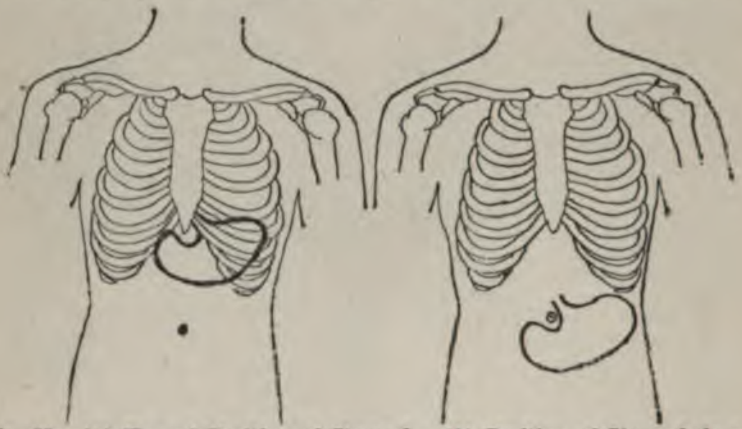

Fig. 68.—(*a*) Normal Position of Stomach. (*b*) Position of Stomach in a Case of Gastroptosis. (Original.)

The chemical examination[1] of the gastric contents syphoned off one hour after feeding a test meal of tea and zwieback, gave the following: 25 cubic centimeters obtained, color greenish yellow, very tenacious, ptyalin present in saliva. Reaction of gastric juice acid, no free hydrochloric present, lactic acid absent, peptones present, sugar present, starch present, combined hydrochloric acid present, estimated by titration equals .02 per cent. hydrochloric acid. A splashing sound could be made out on the left side of the abdomen in the area bounded by the umbilicus or above it to the symphysis pubis. With the aid of the gastrodiaphane the outline of the stomach could be plainly seen extending below the umbilicus. In the accompanying illustration (Fig. 68) the position of the stomach is outlined.

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[1] I am indebted to Mr. LaWall, chemist, for this analysis.

Prognosis and Course.—A displaced organ is not easily replaced by giving drugs or by mechanical treatment. The physician should inform the patient's relatives regarding the true condition. The life of the child is not necessarily endangered by the displaced stomach, yet the abnormality should be treated on the principle of general building up of the entire system with special reference to the diet.

Treatment.—The treatment of these cases consists in building up the system with the aid of electricity, massage, and general restorative treatment; cold sponging with brisk friction of the surface of the body to stimulate the circulation; also, light bodily gymnastics. Nux vomica or its alkaloid, strychnine, should be given for a long time.

A tight fitting abdominal bandage has frequently relieved acute symptoms. Boas, of Berlin; Einhorn, Kemp, and Rose, of New York, are among those who advocate supporting the abdominal muscles by this mechanical device.

Surgical Treatment.—When no relief is obtained by the abdominal supporter or bandage previously referred to, then surgery may be demanded. Some surgeons advise supporting the stomach by means of stitching the omentum to the abdominal peritoneum. By this means we have "a method of suspending the stomach in a hammock made by the great omentum."

ULCER OF THE STOMACH.

Gastric ulcer is frequently seen in chlorotic girls. It is usually the result of living in unsanitary surroundings, or when the body is reduced to a subnormal condition. Young girls at or about the period of menstruation that are sent to work in factories or shops, who cannot take proper time for their meals, are occasionally seen with evidences of gastric ulcer. In most cases the ulcer is simply a continuation of a chronic catarrh of the gastric mucous membrane which has laid the foundation for this condition.

Symptoms.—Pain in the stomach which is distinctly localized and can be pointed to in the same area. The pain increases after taking solid food, although pain is also noted when any liquid enters the stomach. At times bright red blood will be expectorated, although the blood may be very dark in color. There is also a tender area usually localized between the ninth and tenth dorsal vertebræ which is marked on palpation.

Diagnosis.—The positive diagnosis should only be made after a chemical examination of the gastric contents is made. The test meal and the method of examination is described in Part XII, page 915 to which the reader is referred. If an excess of HCl is found in addition to the subjective symptoms of pain, the diagnosis of gastric ulcer is positive.

The following case of gastric ulcer was presented by me before the New York County Medical Association, May 15, 1899:—

Mary B., 13 years old, complained of headaches and general weakness. She was emaciated and had anorexia. She had suffered with constipation, dizziness, nausea, and vomiting. Her heart's action was irregular. For four years she complained of pain in the middle of the stomach which was always localized in the same area. The gastric pains were strongest after partaking of solid food. She had pain whenever any food, solid or liquid, was swallowed. The pain is described as a burning pain. She has a tender area between the ninth and tenth dorsal vertebræ. This tenderness is marked on palpation. Three years ago she had an attack of hæmatamesis, but none since then. The gastric contents were examined after a test meal, and an excess of HCl was found. Owing to the danger of traumatism I thought it best not to repeat the syphoning off of the gastric contents, as there was a risk in repeating the hæmorrhage. There was no evidence of hysteria in the case. The diagnosis of gastric ulcer was made.

Treatment.—Liquid diet, rest in bed, and bismuth gave quite some relief. When solid food was tried the gastric pain returned.

Prognosis and Course.—Great care should be taken before giving a positive opinion concerning the outcome of gastric ulcer. If the conditions that induced the disease can be modified, then a chance for recovery exists. These cases, as a rule, do badly unless placed under the strictest supervision of a trained nurse. Such cases require treatment in bed, rather than ambulant treatment. Years of patient treatment may be required before positive benefit is secured.

The prognosis depends on the above conditions. The disease is chronic and may cause death.

Treatment.—Such cases do well by having a change of air. These children should not be permitted to attend school, and the same applies to the workshop, if the child is working. Sea bathing and cold sponging of the body, followed by friction, is very beneficial. A rigid liquid diet, consisting of peptonized milk, zoolak, soup, broth, and strained gruel, with an occasional change to cocoa, should be allowed. Fruit may also be permitted. This treatment must usually be carried out for months before recovery may be expected.

CYCLIC VOMITING.

A great many writers report attacks of vomiting occurring at irregular or regular intervals of weeks or months which is termed cyclic vomiting. They claim that these attacks are not dependent on acute gastric disturbances, but are simply explosives due to latent or possibly nervous conditions. I cannot agree to the above statement, as in all cases seen by me in which recurring vomiting took place, I could always trace some dietetic error or some auto-intoxication as an exciting factor of the vomiting. Joseph Winters, an authority on pediatrics, ridicules the above condition.

DYSPEPTIC ASTHMA.

Peripheral irritation of the terminal filaments of the pneumogastric nerve frequently causes dyspeptic symptoms which result in asthmatic attacks similar to those found in adults. A case of this kind came under my care in which fermentative conditions in the stomach caused pressure on the diaphragm and gave rise to asthmatic attacks.

A well-nourished boy, 9 years old, was referred to me by Dr. H. Jarecky. He had attacks of coughing, wheezing, and slight cyanosis. The hands and feet were cold. The tongue was coated, the stomach distended with gas and very tympanitic on percussion. The asthmatic attacks were caused by the distention and pressure on the diaphragm, and disappeared when a rigid diet and a laxative was given. The boy suffered in addition with rheumatism.

CHAPTER IV.

DISEASES OF THE INTESTINES.

THE ABDOMEN.

THE abdomen of a child is comparatively larger than that of the adult. Especial attention should be given to the condition of the abdomen; for instance, a retracted abdomen is usually seen in meningitis. (See chapter on "Meningitis.") A distended abdomen is frequently seen in rachitis (pot-belly). (See chapter on "Rachitis.") A very prominent abdomen is seen in chronic peritonitis, to which I direct attention in the special chapter dealing with this subject.

THE INTESTINES.

Small Intestine.—At birth the length of the small intestine is nine and one-half feet. The length of the intestine may, however, vary with the size of the child. In the duodenum Brunner's glands are found. Below the duodenum Peyer's patches are found. The most important physiological function of the small intestine consists in aiding the assimilation of food by the action of the pancreatic juice and other secretions. The emulsification of the fat in the food takes place in the small intestine.

Length of the Intestine.—The relative length of the intestines in nurslings is greater than in adults, so that the intestines are six times as long as the body. Forster believes this is one reason why nurslings receive more nourishment from milk than do adults. The small intestine develops during the first two months of life more than the large intestine, and after the second month the reverse is true. The duodenum remains relatively the longer until the end of the fourth month. The transverse colon is the widest and most elastic portion of the large intestine. The continuation of the large intestine in infants, into the rectum, is indicated by a narrowing at this point.

Large Intestine.—According to Treves the large intestine measures:—

At birth	1 foot 10 inches, or	55 centimeters
At 12 months	2 feet 6 inches, or	76 centimeters
At 6 years	3 feet, or	91.5 centimeters
At 13 years	3 feet 6 inches, or	107 centimeters

Course of the Colon.—From the right iliac fossa up to the liver, then transversely across the abdomen to the spleen and then downward, terminating in the rectum. The colon forms at its first turn the hepatic flexure, at the spleen the splenic flexure, and finally the sigmoid flexure. The curve of the sigmoid flexure occurs in the left iliac fossa.

Sigmoid Flexure.—The anatomical illustrations of the sigmoid flexure (see chapter on "Chronic Constipation") are important to remember in view of the mechanical cause of constipation so frequently seen in young children.

The transverse colon, when distended with gas, is very easily mapped out by percussion.

The Cæcum.—Dwight found the cæcum completely covered with peritoneum in 33 out of 37 cases in young children. Treves states that in 100 cases observed by him, he found the peritoneum infolding the cæcum in all of these cases on its posterior surface.

The cæcum occupies a higher position anatomically in a child than in adult life.

Vermiform Appendix.—Behind the cæcum lies the vermiform appendix. It is important to remember that it lies in the line *midway between the umbilicus and the crest of the ilium.* When the appendix is inflamed and swollen it can frequently be mapped out by recto-abdominal (bimanual) palpation.

Formation of Gas in the Intestine.—When we consider the lesser development of the muscles of the intestine, we can readily understand that peristaltic movements are more irregular and less forcible, and that the muscles possess less tone; on this account *there is a larger amount of gas contained in the intestine, which constantly distends it.* Thus it is apparent why the abdomen always appears larger in the infant in proportion to the other parts of the body.

Action of Intestinal Muscles.—The action of the intestinal muscles is chiefly to transport the food by a series of peristaltic movements. Parts of the intestine are active, while others remain passive. Heubner maintains that post-mortem examinations never show all parts of the intestine in the same condition, owing to the irregularity of the muscular movement.

Development of Glandular System.—The development of the glandular system in infants is very poor, whereas the *lymphoid tissues, and follicles, are comparatively well developed.*

Lieberkühn's glands are fewer in number than in adults, whereas the Brunner glands in the duodenum are numerous and well developed.

The Secretory and Absorbing Power of the Epithelium and the Glands.—Heubner maintains that the secretion takes place from cells, located in the small intestine, which are scattered about and are few in number, whereas in the large intestine they are far more numerous.

Absorption of Fat.—The absorption of fat takes place through the intestinal epithelium in the duodenum and jejunum; the glands also participate in this action. According to the histological investigations by Baginsky, the real absorbing system of the intestinal wall is found in the connective-tissue bodies of the mucous membrane of the infantile intestine, in which are located lymphatic vessels connected with the larger lymph-channels of the intestine. The physiological and chemical functions are much less developed in infants than in adults because the intestinal glands are relatively less developed.

INFANT STOOLS.

Meconium. — The first discharge from an infant's bowels is called meconium. It has a greenish-brown color, at times it resembles ink in color. It is composed of epithelial cells, bile, cholesterin crystals, and partly digested amniotic fluid. Meconium has no odor. It is usually acid in reaction. The color of the infant's stool changes after a few days of maternal or bottle-feeding.

Stool of a Nursling.—The stool of a nursling or a baby on an exclusive milk diet should be yellowish in color, smeary or pasty-like in consistency, and have an acid reaction. The smell should be faintly acid, but not disagreeable. The color is due to bilirubin, and the reaction depends on the presence of lactic acid, the source of which is the milk sugar. The only gases present are H and CO_2. According to Escherich, H_2S and CH_4, to which the odor of adult stools is due, are not present. There are no peculiar albuminoids. Those existing in mothers' milk seem to be entirely absorbed. Peptone exists in trifling amount. Sugar is not present. Pancreatic ferment is absent, and sometimes traces of pepsin have been found. Mucus is always present in considerable quantity; also columnar intestinal epithelium.

In the stool of nurslings large quantities of lactate of lime can be found; so also we frequently find oxalate of lime, depending on the quantity of oxalate of lime ingested. Uffelmann has noted the presence of bilirubin crystals in the stools of nurslings, in perfectly healthy children.

The number of stools during the first two weeks is from three to six daily. After the first month the average is two stools daily; many infants have one, others three stools daily. This latter is due largely to the excessive quantities of water given to infants.

As soon as the exclusive milk diet is changed to the mixed diet we then lose the characteristic infantile stool, and it resembles more that of an adult, though remaining softer and thinner throughout infancy. The stools become darker in color, assume the adult odor, and have more varieties of bacteria than those previously mentioned as found in the stool of a milk diet.

Reaction of Stools.—Reaction of stools in diarrhœal disease and in health is chiefly acid or, next in frequency, neutral. Alkaline stools are rare. Grass-green stools, usually acid, are seen in the early stage of dyspeptic diarrhœa, the color varies from a pale greenish-yellow to grass-green, owing to improper food.

Wegscheider has shown that the green color is the result of preformed biliverdin. The condition in the intestine, upon which the transformation of bilirubin into biliverdin depends, has been generally regarded as one of acid fermentation.

Experiments.—Pfeiffer's experiments[1] show this former opinion to be wrong. He found that none of the acids formed in such fermentation—lactic, acetic, butyric, propionic, etc.,—added to yellow stools outside the body, turned them green, but that they made them deeper yellow. But dilute alkaline solutions added to fresh yellow stools turned them green after an exposure of thirty to sixty minutes, and strong solutions turned them, first, brown; later, after exposure to air, intense green.

Typical Green Stools.—Typical green stools can be produced by giving an infant 2 or 3 grains of bicarbonate of soda. This I have tried dozens of times; the soda must be given for a few days. This explains Pfeiffer's alkaline theory. Typical green stools can also be produced by giving small or even large doses of calomel. If, after having given bicarbonate of soda and produced green stools, we give diluted hydrochloric acid in 5 to 10-drop doses, the yellow color will reappear in a few days. Rhubarb will also produce a yellow stool.

Stools which are pale yellow when discharged, and which afterward become green, are often seen in disease. They may be themselves neutral or alkaline in reaction; this latter may, however, depend on the admixture of urine. An excess of bile may often cause very green stools.

Blood in Stools.—Blood from the stomach or small intestine frequently gives the stool a black color resembling tar. Thus, a practical point in Boas's "Diagnostik der Magen- und Darmkrankheiten" is that, the brighter the color of the blood, the lower down near the rectum and anus must the pathological lesion be looked for; the darker the blood, the higher up must the cause be found; *e.g.*, the diseased conditions exist in the stomach, duodenum, jejunum, etc., if the stool contain black blood. If the corpuscular elements of the blood are wanting, then the presence of blood can only be positively diagnosticated by either a microchemical examination or by means of the spectroscope. The presence of red blood-corpuscles must always be regarded as a pathological factor.

Brown Stools; Muddy Stools.—A brown stool in an infant is frequently caused by a diet of animal food or by a diet principally of broth. These stools have no distinct consistency nor reaction. In dyspeptic diarrhœa or in some forms of enterocolitis we have very offensive stools, and they resemble muddy water; with the latter there is considerable flatus during each movement. Brown-stools may be due to changed biliary pigment and to drugs: *e.g.*, bismuth causes the well-known dark stool. So also tannic acid and all iron salts give the dark stool, which varies from a deep brown to a black color.

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[1] "Verdauung im Säuglings-alter bei Krankhaften Zuständen," Jahrbuch für Kinderheilkunde, B. 28, page 164.

White or Light-gray Stools.—White or light-gray stools usually are of a putty-like consistency, sometimes like dry balls on a diaper; sometimes they appear like ashes. Usually they are very offensive, consisting principally of fat. There is scarcely a trace of bile, or the latter may be absent altogether.

Mucus.—Mucus is always present in all healthy stools, and is so well mixed with the stool that it does not appear as mucus to the naked eye. Any appearance, therefore, of mucus easily visible should be regarded as abnormal. Mucus is present in every form of intestinal disease: very abundant in inflammatory conditions affecting the large intestine, more so than in those affections of the small intestine, and especially so in inflammatory conditions of the colon, both acute and chronic.

Jelly-like Masses.—Jelly-like masses or shreds of mucus, and cases where the stool consists chiefly of mucus, show that the affection is confined to the lower portion of the colon or that it is located in the rectum.

Long Shreds of Mucus.—Long shreds of mucus, frequently resembling false membrane, are often found in catarrh of the large intestine. If the shreds of mucus are intimately mixed with the stool, then we must look for the lesion quite high up, and if it comes from the small intestine it is usually stained from bile. If the lesion is low down the mucus is not intimately mingled with the stool.

Dyspeptic Stool.—The first change noticed in the dyspeptic stool is the increase of fat. Often the stool is quite green and contains small pieces, of yellowish-white color, which vary in size from that of a pin-head to the size of an ordinary pea. Hitherto, from their color, they were supposed to be casein lumps. Wegscheider has taught us that they consist principally of fat. Baginsky has shown that large colonies of bacteria are contained in these lumps of fat. Frequently they are so numerous that it looks as though the stool were composed only of these cheesy lumps. They can be easily differentiated from real casein lumps by their solubility in alcohol and ether.

Fat Diarrhœa.—Biedert and Demme have devoted considerable attention to this subject.[1] In some children the fæces showed 50 to 60 per cent. of fat, whereas the normal percentage in ordinary fæces varied from 14 to 25 per cent. (which is the normal quantity), according to Uffelmann.

Casein is not nearly as common an ingredient of fæces as is commonly supposed. Casein lumps can be seen in abundance in the course of a diarrhœa during an exclusive diet of milk.

Quantity of Fæces.—The quantity of fæces varies, but it has been found that 100 grams of milk food will produce about 3 grams of fæces, according to Baginsky. This is a vital point, but I have found it very difficult to determine, for in most cases the napkins of the infants are soiled with urine plus the fæces, thus adding to the gross weight.

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[1] See Biedert: "Fett-Diarrhea," in Jahrbuch für Kinderheilkunde, 1878.

Proteids.—The proteids of milk are so thoroughly absorbed that only small traces of them can be found in the fæces.

Albuminous decomposition and its products—tyrosin, indol, phenol, and skatol—are not found in milk fæces. But lactic acid, acetic acid, formic acid, and other fatty acids are present, causing the acid reaction.

Saccharine Ferment.—Von Jaksch found a saccharine ferment in the fæces of children.

Peptonizing Ferment.—Baginsky found a peptonizing ferment also in infantile fæces.

Escherich[1] says: "If albuminous decomposition with very foul offensive stools exists, albumins should be withheld from the diet and carbohydrates given, such as dextrin foods, sugars, and milk. If acid fermentation is present, with sour, but not offensive stools, carbohydrates are to be withheld and albuminous foods given, such as animal broths, bouillon, peptones, etc. In the decomposition of milk, the sugar of milk, and not the casein, is usually broken up."

Holt says: "Regarding the exact indications according to which fat, sugar, and proteids of milk are to be varied, much remains to be learned."

Sugar is Too Low.—If the sugar is too low, the gain in weight is apt to be slower than when furnished in proper amount.

Sugar in Excess.—Symptoms indicating an excess of sugar: Colic or thin, green, very acid stools, sometimes causing irritation of the buttocks; sometimes there is regurgitation of food and eructations of gas.

Excess of Fat.—Excess of fat is indicated by the frequent regurgitation of food in small quantities, usually one or two hours after feeding. Sometimes an excess of fat causes very frequent passages very nearly normal in appearance. In some cases the stools contain small round lumps somewhat resembling casein, but really masses of fat.

White Curds in the Stool of a Nursling.—The small white particles resembling cheese found in the stool of a nursing infant, are frequently fat; more often they are casein. A simple test to determine the nature of these white particles is the following: Remove one of these particles with the aid of a small probe or piece of clean wood (a tooth-pick will serve quite well), and place that white particle in ether. If it dissolves it is fat; if it does not dissolve, it is casein.

Dry, Pasty Stools.—When too little fat is given, it is indicated by hard, dry, pasty stools, and usually constipation. This can be easily remedied by the addition of cream, three-fifths of which is fat. Holt speaks against increasing the fat above 4.5 per cent. in infants under six months old, and believes we should not go above 4 per cent.

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[1] Jahrbuch für Kinderheilkunde, "Beiträge zur Antiseptischen Behandlungsmethode der Magen-Darmkrankheiten des Säuglingsalters."

BACTERIA OF THE INTESTINES.

There are a great many bacteria found in the intestines. These are present in a normal infant, as well as in an infant suffering from a gastro-intestinal disorder. A great many of these bacteria are, therefore, non-pathogenic. Miller, who carefully studied the various micro-organisms in the mouth, found that most of them could again be found in the intestinal canal. He also found that certain germs possessed diastasic properties, and were capable of producing lactic-acid fermentation in the milk-fæces of nurslings.

Escherich found two germs, the one he called "bacterium lactis aërogenes (or bacterium aceticum, Baginsky)" and the other the bacterium coli commune. In the meconium he found proteus vulgaris, streptococcus coli gracilis, and bacillus subtilis.

Bacterium Coli Commune (Escherich).—Obtained by Emmerich (1885) from the blood, various organs, and the alvine discharges of cholera patients at Naples; by Weisser (1886) from normal and abnormal human fæces, from the air, and from putrefying infusions; by Escherich (1886) from the fæces of healthy children; since shown to be constantly present in the alvine discharges of healthy men, and probably of many of the lower animals. Found by Sternberg in the blood and various organs of yellow-fever cadavers in Havana (1888 and 1889).

Numerous varieties have been cultivated by different bacteriologists, which vary in pathogenic power and to some extent in their growth in various culture media; but the differences described are not sufficiently characteristic or constant to justify us in considering them as distinct species.

Morphology.—Differs considerably in its morphology as obtained from different sources and in various culture media. The typical form is that of short rods with rounded ends, from 2 to 3 microns in length and 0.4 to 0.6 micron broad; but under certain circumstances the length does not exceed the breadth—about 0.5 micron—and it might be mistaken for a micrococcus; again the prevailing form in a culture is a short oval; filaments of 5 microns or more in length are often observed in cultures, associated with short rods or oval cells. The bacilli are frequently united in pairs. The presence of spores has not been demonstrated. In unfavorable culture media the bacilli, in stained preparations, may present unstained places, which are supposed by Escherich to be due to degenerative changes in the protoplasm. Under certain circumstances some of the rods in a pure culture have been observed by Escherich to present spherical, unstained portions at one or both extremities, which closely resemble spores, but which he was not able to stain by the methods usually employed for staining spores, and which he is inclined to regard as "involution forms."

The bacillus stains readily with the aniline colors usually employed by bacteriologists, but quickly parts with its color when treated with iodine solution—Gram's method—or with diluted alcohol.

Biological Characters.—"An aërobic and facultative anaërobic, non-liquefying bacillus. Sometimes exhibits independent movements, which are not very active. One rod of a pair, in a hanging-drop culture, may advance slowly with a to-and-fro movement, while the other follows as if attached to it by an invisible band (Escherich). The writer's personal observations lead him to believe that, as a rule, this bacillus does not exhibit independent movements. Does not form spores. Grows in various culture media at the room temperature—more rapidly in the incubating oven. Grows in a decidedly acid medium.

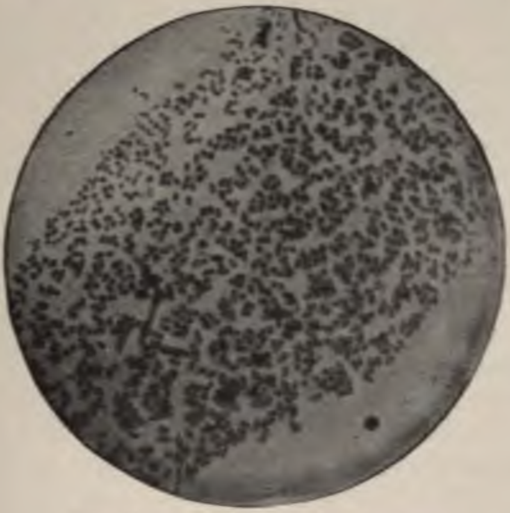

Fig. 69.—Bacterium Coli Commune.

In gelatine plates, colonies are developed in from twenty-four to forty-eight hours, which vary considerably in their appearance according to their age, and in different cultures in the same medium. The deep colonies are usually spherical and at first are transparent, homogeneous, and of a pale straw or amber color by transmitted light; later they frequently have a dark-brown, opaque central portion surrounded by a more transparent peripheral zone; or they may be coarsely granular and opaque; sometimes they have a long oval or "whetstone" form. The superficial colonies differ stil more in appearance; very young colonies by transmitted light often resembl little drops of water or fragments of broken glass; when they have sufficient space for their development they quickly increase in size and may attain a diameter of three to four centimeters; the central portion is thickest, and is often marked by a spherical nucleus of a dark-brown color when the colony has started below the surface of the gelatine; the margins are thin and transparent, the thickness gradually increasing toward the center, as does also the color, which by transmitted light varies from light-straw color or amber to a dark brown. The outlines of superficial colonies are more or less irregular, and the surface may be marked by ridges, fissures, or concentric rings, or it may be granular. The writer has observed colonies resembling a rosette, or a daisy with expanded petals. Escherich speaks of colonies which present star-shaped figures surrounded by concentric rings.

"In gelatine stick cultures the growth upon the surface is rather dry, and may be quite thin, extending over the entire surface of the gelatine, or it may be thicker, with irregular, leaf-like outlines and with superficial incrustations or concentric annular markings. An abundant development occurs all along the line of puncture, which, in the deeper portion of the gelatine, is made up of more or less closely crowded colonies; these are white by reflected light, and of amber or light-brown color by transmitted light; later they may become granular and opaque. Frequently a diffused cloudy appearance is observed near the surface of the gelatine, and under certain circumstances branching, moss-like tufts develop at intervals along the line of growth. One or more gas bubbles may often be seen in recent stick cultures in gelatine.

"Upon nutrient agar and blood-serum, in the incubating oven, an abundant, soft, shining layer of a brownish-yellow color is developed. The growth upon potato differs considerably, according to the age of the potato. According to Escherich, upon old potatoes there may be no growth, or it may be scanty and of a white color. In milk at 37° C., an acid reaction and coagulation of the casein are produced at the end of eight or ten days. In the absence of oxygen this bacillus is able to grow in solutions containing grape sugar (Escherich). In bouillon it grows rapidly, producing a milky opacity of the culture liquid. The thermal death point of Emmerich's bacillus, and of the colon bacillus from fæces, was found by Weisser to be 60° C., the time of exposure being ten minutes. The author has obtained corresponding results. Weisser found that when the bacilli from a bouillon culture were dried upon thin glass covers they failed to grow after twenty-four hours. These results give confirmation to the view that the bacillus under consideration does not form spores.

"*Pathogenesis.*—Comparatively small amounts of a pure culture of the colon bacillus injected into the circulation of a guinea pig usually cause the death of the animal in from one to three days, and the bacillus is found in considerable numbers in its blood. But, when injected subcutaneously or into the peritoneal cavity of rabbits or guinea pigs, a fatal termination depends largely on the quantity injected; and, although the bacillus may be obtained in cultures from the blood and the parenchyma of the various organs, it is not present in large numbers, and death appears to be due to toxæmia rather than to septicæmia. Mice are not susceptible to infection by subcutaneous injection. Small quantities injected underneath the skin of guinea pigs usually produce a local abscess only; larger amounts—2 to 5 cubic centimeters—frequently produce a fatal result, with symptoms and pathological appearances corresponding with those resulting from intravenous injection. These are fever, developed soon after the injection, diarrhœa, and symptoms of collapse appearing shortly before death. At the autopsy the liver and spleen appear normal, or nearly so; the kidneys are congested and may present scattered punctiform ecchymoses (Weisser). According to Escherich, the spleen is often somewhat enlarged. The small intestine is hyperæmic, especially in its upper portion, and the peritoneal layer presents a rosy color; the mucous membrane gives evidence of more or less intense catarrhal inflammation, and contains mucus, often slightly mixed with blood. In rabbits death occurs at a somewhat later date, and diarrhœa is a common symptom. In dogs the subcutaneous injection of a considerable quantity of a pure culture may give rise to an extensive local abscess."

Varieties.—Booker, in his extended studies relating to the bacteria present in the fæces of infants suffering from summer diarrhœa, has isolated seven varieties "which closely resemble bacterium coli commune in morphology and growth in agar, neutral gelatine, and potato, but by means of other tests a distinction can be made between them." These are described as follows:—

"**Bacillus 'D' of Booker.**—Found in two cases of cholera infantum and the predominating form in one serious case of catarrhal enteritis.

"*Morphology.*—Resembles bacterium coli commune.

"*Growth in Colonies.*—Gelatine: Colonies grow luxuriantly in gelatine, and thrive in acid and sugar gelatine equally as well as in neutral gelatine. In the latter the colonies closely resemble, but are not identical with, the bacterium coli commune. In acid gelatine they differ very much from bacterium coli commune. The colonies spread extensively, and are bluish white, with concentric rings. Slightly magnified, they have a large, uniform, yellow central zone surrounded by a border composed of perpendicular threads placed thickly together. Sometimes a series of these rings appear, with intervening yellow rings.

"Agar: The colonies are round, spread out, and blue or bluish white. Slightly magnified, they have a pale-yellow color.

"*Stab Cultures.*—Gelatine: In sugar gelatine the surface growth has a nearly colorless center surrounded by a thick border, with an outer edge of fine, hair-like fringe; the growth along the line of inoculation is fine and delicate. In neutral gelatine the growth is not so luxuriant as on sugar gelatine; on the surface it is thick and white, with a delicate stalk in the depth.

"Agar: Thick white surface growth, with a well-developed stalk in the depth.

"Potato: Luxuriant yellow, glistening, moist, and slightly raised surface, with well-defined borders.

"*Action on Milk.*—Coagulated into a gelatinous coagulum in twenty-four hours at 38° C., and into a solid clot in two days.

"*Milk-Litmus Reaction.*—Milk colored blue with litmus is changed to light pink in twenty-four hours at 38° C. The pink color gradually fades, and by the second or third day is white or cream color, with a thin layer of pink on top. The pink color extends in a few days about one-half down the clot.

"*Temperature.*—Grows best about 38° C.

"Spores have not been observed.

"*Gas-production.*—Gas bubbles are produced in milk; not observed on potato."

"**Bacillus 'E' of Booker.**—Found as the predominating form in two cases of dysentery, one of which was fatal and the other a mild case.

"*Morphology.*—Resembles bacterium coli commune.

"*Growth in Colonies.*—Gelatine: The colony growth varies considerably with slight difference in the gelatine. In 10 per cent. neutral gelatine the colonies resemble those of bacterium coli commune. On the second or third day, when the colonies have just broken through the surface and are spread out, it is impossible to distinguish one variety from the other, but as the colonies grow older a difference can generally be recognized. In sugar and acid gelatine the colonies have a clear center with white border. Slightly magnified, a uniform brown center surrounded by a brown zone composed of fine, needle-like rays perpendicular to the border. After cultivating for a few generations on acid and sugar gelatine the colonies cease to develop, and either grow in very small colonies or do not grow at all. The activity is regained if cultivated on neutral gelatine.

"Agar: Colonies are large, round, and have a mother-of-pearl appearance. Slightly magnified, a uniform yellow color.

"*Stab Cultures.*—Agar: Luxuriant, nearly colorless surface growth, with well-developed stalk along the line of inoculation in the depth.

"Potato: Golden-yellow, glistening, slightly raised surface, with well-defined borders.

"*Action on Milk.*—Milk becomes gelatinous in twenty-four hours at 38° C., and in a few days a solid coagulum is formed. Milk colored blue with litmus is reduced to white or cream color in twenty-four to forty-eight hours at 38° C., with a thin layer of pink at the top of the culture. The pink color gradually extends lower in the coagulum.

"*Temperature.*—Thrives best at about 38° C.

"Spores have not been observed.

"*Gas-production.*—Occurs in milk, but not seen in potato cultures.

"*Relation to Gelatine.*—Does not liquefy gelatine.

"*Resemblance.*—Resembles bacterium coli commune and bacillus 'd,' differing from the former in the character of the colony growth on acid and sugar gelatine and in ceasing to develop in these media after several generations. It differs from bacillus 'd' in this latter respect."

"**Bacillus 'F' of Booker.**—Found in one case of cholera infantum and one case of catarrhal enteritis.

"*Morphology.*—Resembles bacterium coli commune.

"*Growth in Colonies.*—Gelatine: It is difficult to distinguish the colony growth from the bacterium coli commune. There is often a difference in the colonies planted at the same time and kept under similar conditions, but it is not very marked nor always the same kind of difference. The tendency to concentric rings is greater in this variety. The colonies develop somewhat better on neutral and sugar gelatine than on acid gelatine.

"Agar: The colonies are large, round, and bluish white. Slightly magnified, a light-yellow color.

"*Stab Cultures.*—Gelatine: The culture is spread over the surface and has a mist-like appearance; in the depth along the line of inoculation is a delicate stalk.

"Agar: Thick, luxuriant, white surface growth, with a well-developed stalk along the line of inoculation in the depth.

"Potato: Bright-yellow, glistening, moist surface, with well-defined borders, and but slightly raised above the surrounding potato.

"*Action on Milk and Litmus Reaction.*—Milk is coagulated into a solid clot in twenty-four hours at 38° C., and in forty-eight hours is reduced to white or cream color with a thin pink layer on top.

"*Gas-production.*—Gas bubbles arise in milk cultures, but they have not been observed on potato cultures.

"*Temperature.*—Grows better at 38° C.

"Spores have not been observed.

"*Relation to Gelatine.*—Does not liquefy gelatine.

"*Resemblance.*—It closely resembles bacterium coli commune and Brieger's bacillus in the character of its growth upon different media, but is readily distinguished from both, as is also Brieger's bacillus from the bacterium coli commune, by the following differential test recently made known by Dr. Mall: Yellow elastic tissue from the ligamentum nuchæ of an ox is cut into fine bits and is placed in test tubes containing water with 10 per cent. bouillon and 1 per cent. sugar, and sterilized from one and one-half to two hours at a time for three consecutive days. Into this is inoculated two species of bacteria, one of which is the bacterium under observation, the other a bacillus found in garden earth. The latter bacillus is anaërobic; grows in hydrogen, nitrogen, and ordinary illuminating gas; in the bottom of bouillon; in the depth, but not on the surface, of agar stab cultures, and not at all in gelatine stab cultures. It has a spore in one end, making a knob bacillus. Different species of bacteria—streptococcus indicus, tetragenus, cholera, swine plague, bacterium lactis aërogenes, bacterium coli commune, Brieger's bacillus, and a number of varieties of bacteria which I have isolated from the fæces—were inoculated with head bacillus into the above described elastic tissue tubes. The tubes inoculated with Brieger's bacillus develop a beautiful purple tint, which started as a narrow ring at the top of the culture, gradually extending downward and deepening in color until the whole tube has a dark-purple color. This color reaction began in five to fourteen days, and was constantly present in a large number of tests. Tubes inoculated with bacillus 'f' gave a much fainter purple color, which was longer in appearing and never became so dark as with Brieger's bacillus.

"Tubes inoculated with the other species of bacteria above mentioned gave no color change and remained similar to control. Bacillus 'f' also shows a slight difference from bacterium coli commune in coagulating milk and reducing litmus more rapidly, and appears to produce more active fermentation in milk. Like Brieger's bacillus, the gelatine colonies more frequently show a concentric arrangement than those of the bacterium coli commune."

"**Bacillus 'G' of Booker.**—Found in one case of serious gastro-enteric catarrh. It was not in large quantity.

"*Morphology and Biological Characters.*—In morphology, character of growth on agar, gelatine, and potato, it resembles bacterium coli commune.

"*Action on Milk and Litmus Reaction.*—Milk is not coagulated, and milk colored blue with litmus is changed to pink in a few days, and holds this color. These characteristics distinguish it from the bacterium coli commune.

"*Gas-production.*—Not observed in milk or potato cultures.

"*Relation to Gelatine.*—Does not liquefy gelatine."

"**Bacillus 'H' of Booker.**—Found in one case of mild dysentery, not in large quantity.

"*Morphology.*—Resembles bacterium coli commune.

"*Growth in Colonies.*—Gelatine: In plain neutral gelatine the colonies resemble those of bacterium coli commune. In sugar gelatine the colonies are white and spread extensively. Slightly magnified, they have a round, dark center surrounded by a yellow, loose zone with an outer white rim; later the whole colony has a uniform yellow color and is not compact.

"Agar: Colonies are white, round, and large. Slightly magnified, they are brownish yellow.

"*Stab Cultures.*—Nothing characteristic in gelatine and agar.

"Potato culture is yellow, dry, and slightly raised, with well-defined borders.

"*Action on Milk and Litmus Reaction.*—Milk is coagulated into a solid clot in two days at 38° C. Milk colored blue with litmus is changed to pink in twenty-four hours.

"*Gas-production.*—Occurs in milk; not observed on potato.

"*Relation to Gelatine.*—Does not liquefy gelatine."

"**Bacillus 'K' of Booker.**—Found in two cases of cholera infantum and one of catarrhal enteritis.

"*Morphology.*—Resembles bacterium coli commune.

"*Growth in Colonies*—Gelatine: In neutral gelatine the colonies cannot be distinguished from those of bacterium coli commune. In acid gelatine the colonies do not spread so extensively as those of bacterium coli commune, and they have a decided concentric arrangement; a wide white center surrounded by a narrow, transparent blue ring; and outside of this a white border. Slightly magnified, the colonies have an irregular, yellowish-brown center, mottled over with dark spots and surrounded by a light-yellow ring bordered by a brownish-yellow wreath.

"Agar: Colonies are large, round, and bluish white. Slightly magnified, a light-brownish-yellow color.

"*Stab Cultures.*—Gelatine: In sugar gelatine the surface growth is extensive; nearly colorless; and has a rough, misty appearance. In the depth is a delicate growth. In plain neutral gelatine the surface growth is bluish white, thick, and not so extensively spread; the growth in the depth is also thicker.

"Potato culture is moist, dirty-cream color, has raised surface and defined border.

"*Action on Milk.*—Milk becomes gelatinous in twenty-four hours at 38° C., and a solid clot in two days. Milk colored blue with litmus is changed to pink in twenty-four hours, and reduced to white, with a pink layer on top, in two days."

"**Bacillus 'N' of Booker.**—Found in large quantity, but not the predominating form, in one case of chronic gastro-enteric catarrh (extremely emaciated).

"*Morphology.*—Resembles bacterium coli commune.

"*Growth in Colonies.*—Gelatine: In neutral gelatine the colonies are spread out and have a frosty, or ground-glass, appearance. The center is blue and border white, but both have the ground-glass appearance. Slightly magnified, the central part is light yellow and the border brown, with a rough, furrowed surface. In acid gelatine the white border is wider and the surface is rougher.

"Agar: Colonies are round, blue, or bluish white, and spread out. Under the microscope they have a light-yellow color.

"*Stab Cultures.*—Gelatine: Has a rough, nearly colorless surface growth, and a thick stalk in the depth along the line of inoculation.

"Agar: Thick white surface growth, with well-developed stalk in the depth.

"*Action on Milk and Litmus Reaction.*—Milk remains liquid and milk colored blue with litmus is changed to pink.

"*Gas-production.*—Not observed in milk or potato cultures.

"*Relation to Gelatine.*—Does not liquefy gelatine.

"Spores have not been noticed."[1]

Bacterium Lactis Aërogenes. — *Synonym:* Bacillus lactis aërogenes (Escherich).

Obtained by Escherich (1886) from the contents of the small intestine of children and animals fed on milk; in smaller numbers from the fæces of milk-fed children, and in one instance from uncooked cows' milk.

Morphology.—Short rods with rounded ends, from 1 to 2 microns in length and from 0.1 to 0.5 micron broad; short-oval and spherical forms are also frequently observed, and under certain circumstances longer rods —3 microns—may be developed; usually united in pairs, and occasionally in chains containing several elements. In some of the larger cells Escherich has observed unstained spaces, but was not able to obtain any evidence that these represent spores.

This bacillus stains readily with the ordinary aniline colors, but does not retain its color when treated by Gram's method.

Biological Characters.—An aërobic (facultative anaërobic), non-liquefying, non-motile bacillus. Does not form spores. Grows in various culture media at the room temperature—more rapidly in the incubating oven. Upon gelatine plates, at the end of twenty-four hours, small, white colonies are developed. Upon the surface these form hemispherical, soft, shining masses which, examined under the microscope, are found to be homogeneous and opaque, with a whitish luster by reflected light. The deep colonies are spherical and opaque, and attain a considerable size. In gelatine stick cultures the growth resembles that of Friedländer's bacillus; *i.e.*, an abundant growth along the line of puncture and a rounded mass upon the surface, forming a "nail-shaped" growth. In old cultures the upper part of the gelatine is sometimes clouded, and numerous gas bubbles may form in the gelatine. Upon the surface of nutrient agar an abundant, soft, white layer is developed. Upon old potatoes, in the incubating oven, at the end of twenty-four hours a yellowish-white layer, several millimeters thick, is developed, which is of paste-like consistence and contains about the periphery a considerable number of small gas bubbles; this layer increases in dimensions, has an irregular outline, and larger and more numerous gas bubbles are developed about the periphery, some the size of a pea; later the whole surface of the potato is covered with a creamy, semifluid mass filled with gas bubbles. On young potatoes the development is different; a rather luxuriant, thick, white or pale-yellow layer is formed, which is tolerably dry and has irregular margins; the surface is smooth and shining, and a few minute gas bubbles only are formed after several days.

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[1] Sternberg's "Manual of Bacteriology," 1892.

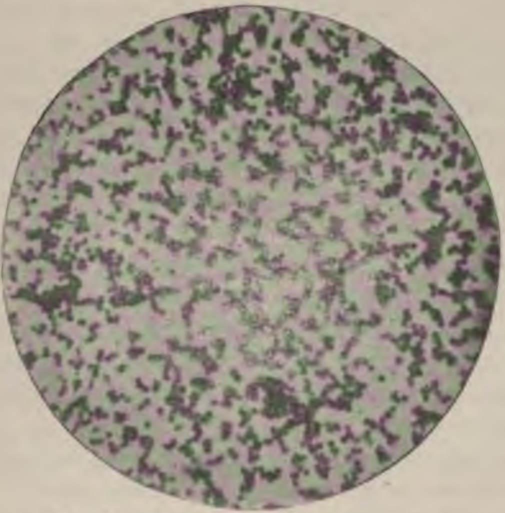

Fig. 70.—Bacterium Lactis Aërogenes.

Pathogenesis.—Injections of a considerable quantity of a pure culture into the circulation of rabbits and of guinea pigs give rise to a fatal result within forty-eight hours.

In his first publication relating to "the bacteria found in the dejecta of infants afflicted with summer diarrhœa," Booker has described a bacillus which he designates by the letter "b," which closely resembles bacillus lactis aërogenes and is probably indentical with it. He says:—

"*Summary of Bacillus 'b.'*—Found nearly constantly in cholera infantum and catarrhal enteritis, and generally the predominating form. It appeared in larger quantities in the more serious cases. It was not found in the dysenteric or healthy fæces. It resembles the description of the bacillus lactis aërogenes, but the resemblance does not appear sufficient to constitute an identity, and, in the absence of a culture of the latter for comparison, it is considered a distinct variety for the following reasons: Bacillus 'b' is uniformly larger, its ends are not so sharply rounded, and in all culture media, long thick filaments are seen, and many of the bacilli have the protoplasm gathered in the center, leaving the poles clear. There is some difference in their colony growth on gelatine, and in gelatine stick cultures bacillus 'b' does not show the nail-form growth with marked end swelling in the depth. In potato cultures the bacillus lactis aërogenes shows a difference between old and new potatoes, while bacillus 'b' does not show any difference.

"Bacillus 'b' possesses decided pathogenic properties, which were shown both by hypodermic injections and feeding with milk cultures."

DIARRHŒA.[1]

By diarrhœa is meant too frequent stools. This increased peristalsis is usually due to some specific cause. Infants on a liquid diet are more prone to loose evacuations than older children on a solid or semi-solid diet. Children suffering from rickets or athrepsia infantum, or any form of malnutrition, are more prone to the development of diarrhœa. The cause of the bulk of the cases of diarrhœa seen by me during the last fifteen years in one of the largest dispensaries of New York City, was bottle-feeding. Out of 1000 cases of diarrhœa 900 were bottle-fed and lived amid poor hygienic surroundings. In 90 cases the children were breast-fed, but there was a disturbance during lactation. This disturbance was pregnancy, menstruation, tuberculosis, or syphilis in the mother, or prolonged nursing with deficient fats and proteids.

In 10 cases there was no assignable cause excepting the subnormal condition of the body due to an excess of midsummer heat.

Contaminated Milk.—Impurities such as bacteria, filth, and chemical products due to fermentation can easily cause diarrhœa. In my article on "Bacteria in the Intestine," I describe the two most frequent varieties of bacteria which are normally found in the intestine. They are the bacterium coli and the bacterium lactis. These bacteria frequently assume a virulent form under certain conditions. They very often cause diarrhœa. Other bacteria, such as the streptococci, can be introduced in cows' milk. *A diseased udder in the cow will frequently secrete pus in addition to milk.* Such milk must necessarily cause trouble when introduced into the infantile stomach or bowels.

Improper Diet for Older Children.—We frequently see people who think it wise to give their children, *regardless of their age,* a bit of anything from the table. Raw fruits and raw vegetables, cabbage, and pickles are given regardless of the consequences. In studying the dietetic sins committed by the parents of children in two dispensaries located in different sections of New York City, I found the following conditions:—

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[1] See also chapter on "Acute Milk Infection."

One hundred children between the second and sixth years of age living in tenements apparently healthy; 80 received a taste of beer or a drop of whisky diluted with water every day. In some families the children received as much as a wineglassful and more of beer with each meal. Such imprudence is frequently a distinct factor in the causation of diarrhœa.

Nervous Diarrhœa.—The influence of fright or excitement is the best example of diarrhœa due to nervous influence that can be given. When caused by a nervous influence the fæces contain mucus, and there is usually an explosive stool. It is a form of exaggerated peristalsis. Chilling the surface of the body frequently provokes diarrhœa.

Diarrhœa as a Symptom of Disease.—Nature's method of eliminating poison is frequently seen when a diarrhœa commences in the course of an acute infectious disease. Toxic products can best be eliminated by the emunctories, and the intestines are one of the most valuable agents for eliminating poison from the body. The diarrhœa of typhoid fever, summer complaint, dysentery, and ileo-colitis have been described in their respective chapters.

Treatment.—Seek the cause and if possible remove the same. If a dietetic error has caused the diarrhœa, then a good dose of castor-oil should be given. In all events a good cleansing should begin the treatment. Mist. rhei et soda in teaspoonful doses can be given several times to cleanse the gastro-intestinal tract. Several hours after the laxative has been given the rectum and colon should be flushed with hot water containing a teaspoonful of salt to each pint. The temperature of the saline solution should be about 110° F.

Bismuth in 3 to 10-grain doses, repeated every two hours, is our best remedy.

℞ Mist. creta.. 2 ounces
One teaspoonful every two hours, is also valuable.

Diet.—Stop all milk. Give whey and rice water thickened with potato flour or wheat flour. Give the white of egg several times a day; also cocoa and water.

For Thirst.—Give 5 to 10 drops of diluted hydrochloric acid in a tumblerful of boiled water (sterilized). This can be given *ad libitum.*

Diluted phosphoric acid, 20 drops to a tumblerful of sweetened water, is a pleasant drink during fever. It is also stimulating.

The following charts were kindly furnished to me by Dr. William H. Guilfoy, Chief of the Bureau of Statistics, Health Department, City of New York:—

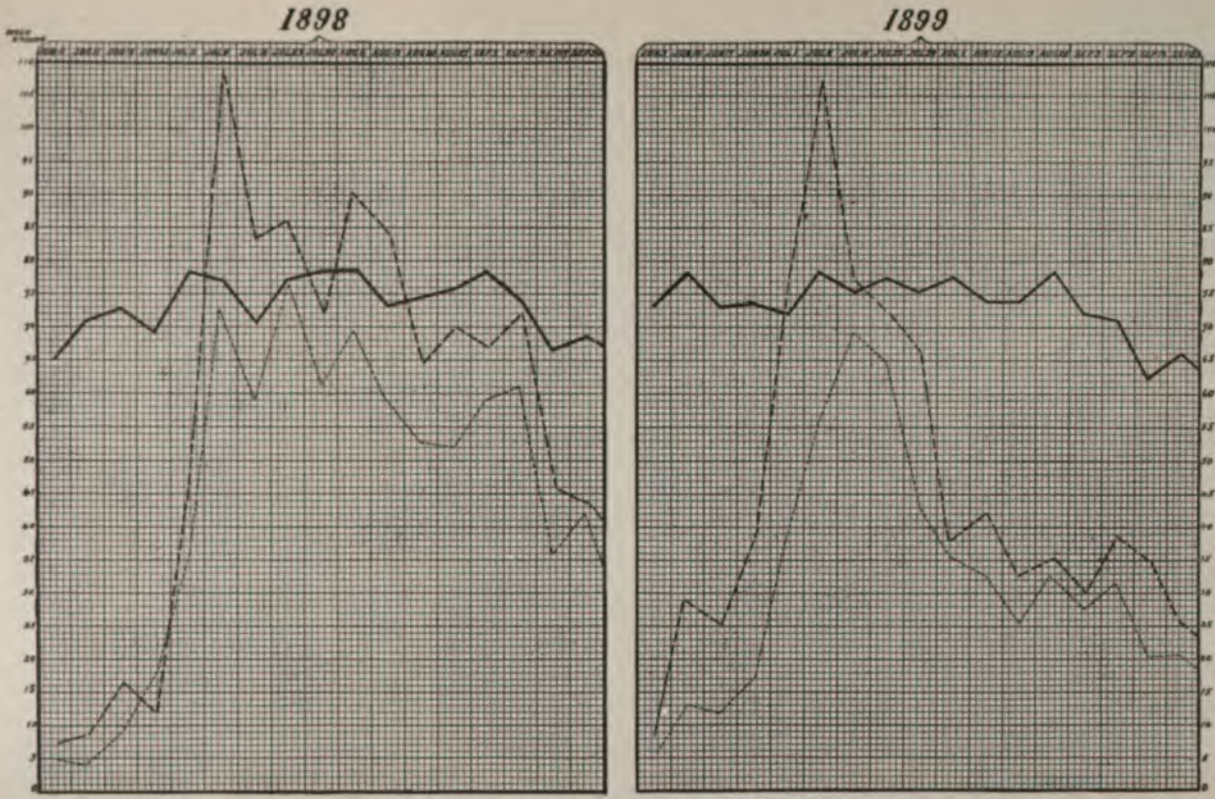

Fig. 71

·········· Death Rates per 10,000 of population under 5 from Diarrhœas, Borough of Manhattan.
– – – – – Death Rates per 10,000 of population under 5 from Diarrhœas, Borough of Brooklyn.
━━━━━ Mean Weekly Temperature.

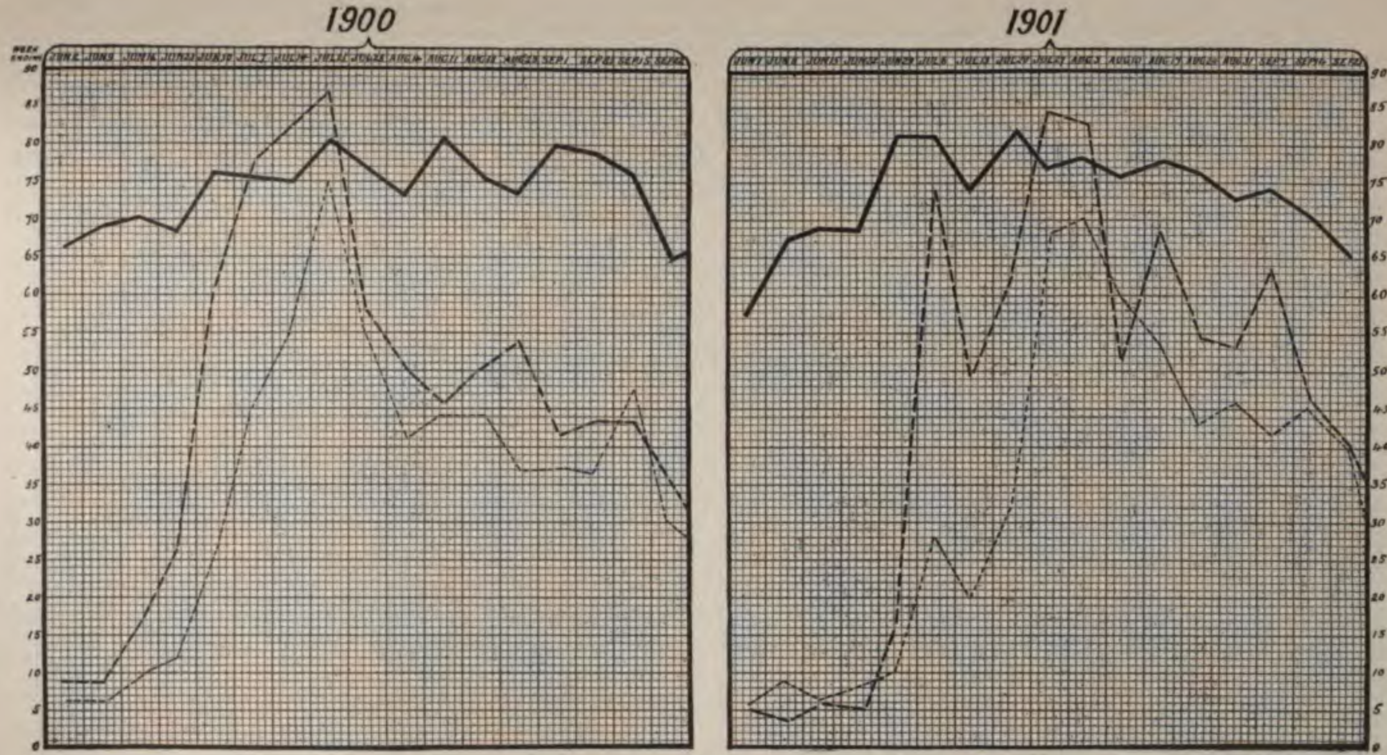

Fig. 71*a*.

┈┈┈┈┈┈Death Rates per 10,000 of population under 5 from Diarrhœas, Borough of Manhattan.
— — — —Death Rates per 10,000 of population under 5 from Diarrhœas, Borough of Brooklyn.
━━━━Mean Weekly Temperature.

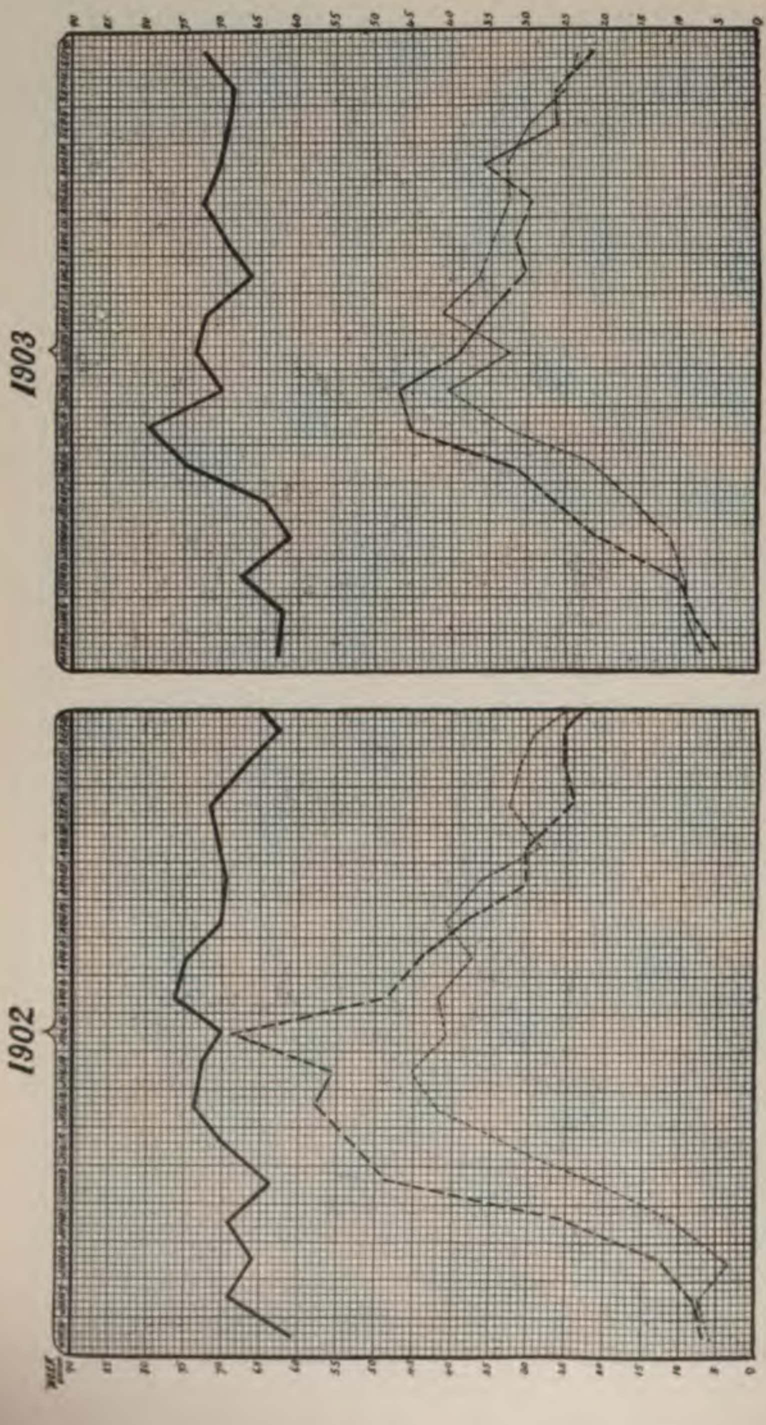

Fig. 71b.

……… Death Rates per 10,000 of population under 5 from Diarrhoeas, Borough of Manhattan.
— — — Death Rates per 10,000 of population under 5 from Diarrhoeas, Borough of Brooklyn.
——— Mean Weekly Temperature.

DYSENTERY (ILEO-COLITIS).

The lower portion of the intestine is frequently the seat of an infection by pathogenic bacteria.

Pathology.—As this condition frequently follows severe milk infection, the pathogenic lesions are necessarily the same, although in a more aggravated form. In addition to the hyperæmia of the mucous membrane there may be a small hæmorrhage in the mucosa or submucosa. The mucous membrane is very deeply pigmented, frequently being of a purplish line. The solitary lymph follicles along the colon are swollen. The discharge of mucus is tinged with blood, and not infrequently the amœba coli described by Lösch, or known as the *amœba dysenteriæ,* described by Councilman and Lafleur, can be found. "It is a unicellular, protoplasmic, motile organism from 10 to 20 micro-millimeters in diameter, and consists of a clear outer zone (ectosarc) and a granular inner zone (endosarc), containing a nucleus and one or more vacuoles." Multiple abscesses are frequently found. "The ulcer first begins as a small papule, the upper part of which sloughs off, leaving a grayish-yellow ulcerating surface."

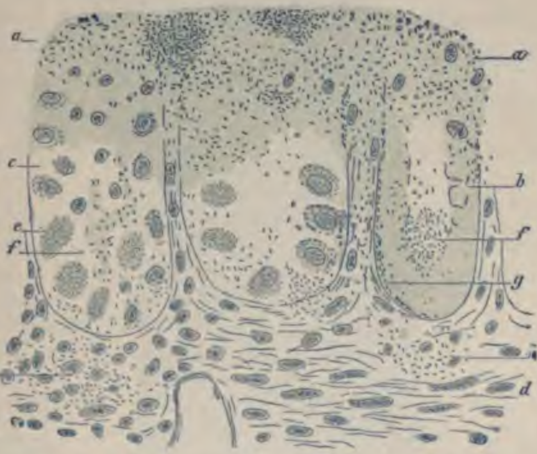

Fig. 72.—Bacillary Diphtheria of the Colon or Diphtheritic Colitis. *a*, Necrotic tissue containing bacilli. *b*, Gland with necrotic epithelium. *d*, Connective tissue. *e*, Degenerated and exfoliated epithelial cells. *f*, Bacilli in the lumen of the gland. *g*, Bacilliary deposit beneath the epithelium. *h*, Nests of bacilli in the connective tissue. X 300. (Ziegler.)

Amœbic Dysentery.[1]—Five cases are reported. The diagnosis was based upon the findng of motile amœbæ containing red blood-corpuscles. The cases were moderate in intensity. The age of the children was 2 to 5 years. Four were boys. They came under observation at the dispensary.

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[1] Amberg: Bulletin Johns Hopkins Hospital, December, 1901.

Little fever was present. The stools varied in frequency from four to twenty-four. Only one complained of much pain. In two cases prolapsus recti occurred. No abscess of liver was found. The reaction of the fæces was mostly alkaline. They were offensive, liquid or solid, and accompanied by bloody mucus. The amœba may be found only on repeated examination. If in the passages of a child Charcot-Leyden crystals are found, amœbic dysentery should be considered. The blood picture varied greatly. A leucocytosis (13,800 to 27,000) existed in every case when first examined.

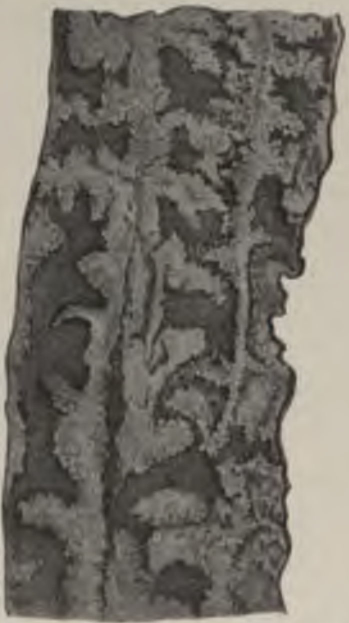

Fig. 73.—Croupous Enteritis, Diphtheritic Colitis, two-thirds natural size. (Langerhans.)

Diphtheritic dysentery, sometimes known as the croupous variety, is a catarrhal form of this same condition previously described, in which the infection can be traced to an invasion of the Klebs-Loeffler bacillus. The ulcerations are covered with a pseudo-membrane, and the pathogenic conditions are as previously described.

Bacteriology.[1]—There are two groups of bacilli which are responsible for the development of various types of epidemic dysentery.

1. The true Shiga group.
2. Group of mannite fermenters.

The latter group is divided into two types:—

(a) Fermenting mannite alone in peptone solution.

(b) Fermenting maltose and saccharose.

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[1] The Journal of Medical Research, vol. xi, No. 2, May, 1904.

Park, Collins, and Goodwin believe that it is more practical to divide the bacilli, having the characteristics of the bacillus isolated by Shiga, and call them dysentery bacilli. The other two groups resemble more closely the colon group, in that they produce indol and have a greater range of activity in fermenting carbohydrates, hence they are called para-dysentery. Park believes that the prefix para will distinguish that form of dysentery occasionally seen in epidemics of the milder type.

When a case of dysentery is found in a family it should immediately be isolated. The infection can no doubt be disseminated through the alvine discharges.

According to a statement of Dr. W. H. Park to the author, the Shiga bacillus is present in all the stools found in New York City which contain blood and mucus.

The following case attended by me in the family of Dr. J. Morgenstern will serve to illustrate the character of dysentery as seen in New York City:—

CASE I.—(*a*) A child about 4 years old was taken sick after an imprudent diet, with bloody stools and general symptoms of dysentery. There were the usual gastric disturbances. After a careful diet and intestinal astringents, such as bismuth and chalk mixture, the child recovered.

(*b*) Several days later a female infant in the same family, 13 months old, was suddenly attacked with diarrhœa. The infant had from ten to thirty evacuations a

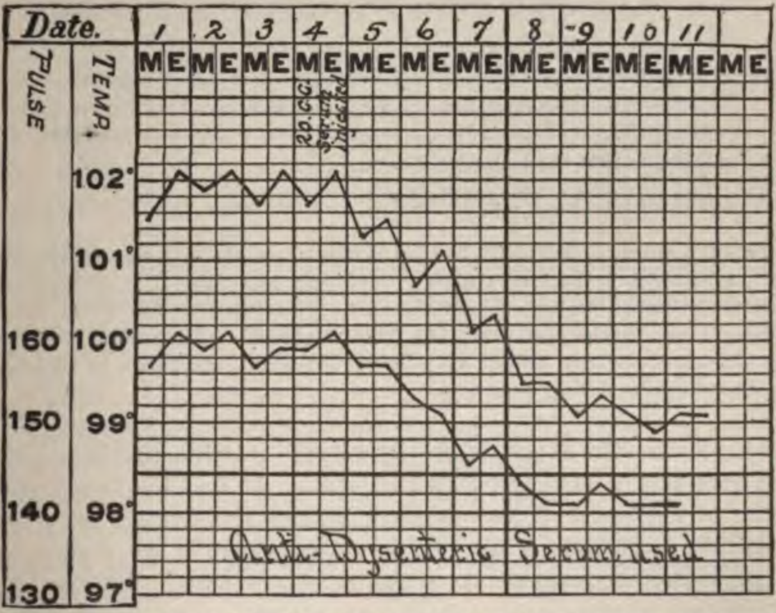

Fig. 74.—Dysentery. Baby M., Thirteen Months Old. Seen Fourth Day of Illness. Serum Injected. (Original.)

day. When I first saw the child the stools contained blood for the past four days. The child had been perfectly well during the summer. Was breast-fed until September. Since weaning there has been more or less gastro-intestinal trouble.

Treatment.—The usual astringents, such as bismuth and chalk mixture, were tried with little or no success. High colon flushings of starch water and a weak solution of nitrate of silver were tried with no benefit whatsoever. The bloody stools continued and the doctor reported that there was more tenesmus, also a prolapse of the rectum. I discontinued the colon flushings and injected 20 cubic centimeters of anti-dysenteric serum.[1] Decided improvement was noticed after the serum injection. Two days later the stools decreased in number and there was no more evidence of blood.

Four days after the injection the bowels did not move for twenty-four hours. The appetite improved and the child convalesced. I ordered some iron internally as an astringent and restorative. A careful diet was ordered of cocoa with diluted milk, rice and gelatine pudding.

CASE II.—A child of Dr. M., eighteen months old, was seen by me in August of 1903. The family was at Long Branch. The following history was given. There was vomiting and diarrhœa, great prostration, loss of appetite, and extreme thirst. The stools contained blood and mucus. There was severe tenesmus. The child had stools as frequently as every five or ten minutes. The pulse was very small and thready. The heart sounds were feeble. The temperature in rectum, 101° F. The diagnosis of dysentery was made.

Treatment.—The rectum and colon were cleansed with a pint of starch water, to which a half-teaspoonful of alum was added. Two teaspoonfuls of castor-oil were given by mouth.

Milk was stopped and whey was ordered. Twelve hours later the child was again seen, and as there was no improvement suppositories containing the following were ordered:—

℞ Argent. nitrat.	1 grain
Oleoresin terebinthin.	10 grains
Cocoa butter	2 drachms

M. and divide into suppositories No. x.

Sig. One suppository every three hours.

Twelve hours after the above treatment was begun, the diarrhœa still persisted, and the exhaustion and heart weakness were very alarming. I injected 10 cubic centimeters of anti-dysenteric serum (Harris). This injection was given into the connective tissue of the abdomen. The child improved rapidly, and I believe the serum aided the recovery. Elixir of calisaya and wine were given, in addition to coffee, as stimulants during illness.

Symptoms.—The attack is usually ushered in with diarrhœa. There is also considerable straining with each stool. At first the stools contain particles of fæces, and as the disease progresses they become more liquid and contain mucus and blood. Some authors describe the stool as containing shreds that resemble the washings of raw meat. The face shows a very anxious expression. There is extreme pallor. The child appears prostrated. The pulse is accelerated and very feeble. The abdomen is distended, especially over the colon. Vomiting is a rare symptom. Unless treatment is rapidly instituted the child will fail in strength and may die. Such children usually sleep with the eyes half open and show evidences of collapse. The rectum may protrude, especially when there is a distinct relaxation of these parts. Cold, clammy perspiration is usually found, especially on the head. The extremities are cold. Convulsions appear in the severer forms of dysentery. In the diphtheritic variety the temperature and pulse resemble a case of true diphtheria. The stool, in addition to mucus and blood, may have particles of pseudo-membrane. Toxæmia can usually be seen by its effect on the heart and pulse. The urine may contain albumin. Where the toxæmia progresses, convulsions may set in and death result from cardiac paralysis.

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[1] For the serum I am indebted to Dr. William H. Park, of the New York Health Department.

Diagnosis.—The bloody mucus and watery stools seen in this condition, associated with tenesmus, will usually aid in eliminating acute milk infection. In gastro-enteritis and entero-colitis there is usually a greenish spinach-like stool, or a brown muddy stool having a very fœtid odor. The stools in dysentery are smaller in quantity. Both the diphtheritic and the amœbic forms of dysentery are rare in children.

Prognosis.—If this disease is epidemic, or if it occurs in children having bad sanitary surroundings, then the prognosis is bad. The duration of an acute attack usually lasts about five or six days. The prognosis is good when the diarrhœa and blood gradually disappear. The main point to remember is that the heart must be sustained by proper nutrition, and we should try to counteract the toxæmia by proper stimulation.

Treatment.—The same hygienic measures described in the chapter on "Acute Milk Infection" apply equally as well here. Impress the mother or nurse that unless she carries out the directions minutely, the child has little chance of recovery.

Dietetic Treatment.—The dietetic management will consist in leaving out milk. Whey, barley water, rice water, or toast water may be given. Mutton broth thickened with rice may be given to an older child. Whisky and water should be given from the beginning. It is not too much to give 2 to 4 ounces of whisky per day. The physician should order the amount of whisky by telling the mother or nurse to give $^1/_2$ drachm or more well diluted with barley or rice water, every half-hour.

Coffee is a valuable cardiac stimulant. Champagne may also be given.

Local Treatment.—The physician will be most successful who places his patient in bed, regulates the diet, cleanses the intestinal tract, and relieves the tenesmus by local treatment. The heart should be supported. The strength must be sustained with nutrition and the flushing of the bowel should be performed as soon as possible after a stool is evacuated.

Warm chamomile tea should be used to cleanse the colon and rectum. This should be injected at a temperature of 110° to 115° F., with the aid of a small rubber catheter. This can be followed by an injection of 1 ounce of sterile water containing 2 grains of nitrate of silver. Very bland injections, such as

℞ Raw starch	1 teaspoonful
Chamomile tea	1 quart
Laudanum	10 drops

injected at a temperature of 100° F., will soothe the rectum and frequently relieve tenesmus. I have successfully treated dysentery cases with the following:—

℞ Argentum nitrate	6 grains
Oleo resin terebinthinæ	12 grains
Extract of belladonna	6 grains
Extract of opii aquosa	1 grain
Cocoa butter	q. s.

M. Form into twelve suppositories.

One of these suppositories to be inserted into the rectum, and the buttocks supported so that it is retained at least fifteen minutes. This is to be repeated three times a day. Sulpho-carbolate of soda, in doses of 5 to 10 grains, can be used several times a day. Bismuth combined with Dover's powder is frequently valuable. An ice-bag placed on the abdomen in the region of the colon will sometimes do good. Very cool injections of table salt and water are sometimes of value when hot injections are not well borne.

Serum Treatment.—The value of serum treatment can best be judged by reading the clinical cases in this article.

CONSTIPATION AND CHRONIC CONSTIPATION.

The bowels of an infant during the nursing period should have one, two, or three evacuations daily. Some children will be quite normal with one evacuation daily. Older children who partake of solid food suffer more frequently with constipation. There are decided peculiarities noted in children with reference to the movements of the bowels. One child will enjoy good health, have a good appetite, and will gain in weight with three or four movements of the bowels daily. Another child in equally good health will have but one movement daily. These differences or peculiarities must be taken into consideration before definitely maintaining that our patient is really constipated. If a child has no movement in twenty-four hours, I usually suspect constipation. When this condition continues for a period of weeks or months, then we may say chronic constipation exists.

Causes.—*1. Dietetic. 2. Anatomical. 3. Systemic.*

Dietetic Causes.—This condition is most frequently met with in bottle-fed infants. There are several causes which generally contribute to stagnant fæces:—

First.—Cows' milk with its thick casein is much more difficult to digest. An excess of casein in the food frequently induces constipation. In some infants the moment we increase to more than 1 per cent. of casein, constipation will result. A deficiency in the amount of sugar will frequently cause constipation. This applies to breast-fed infants as well as to bottle-fed infants.

Second.—The application of heat to milk, especially when sterilization is continued, results in constipation.

Third.—When milk contains a deficiency of fat the excess of casein will stagnate.

Fourth.—The infant is frequently dyspeptic or rachitic, and in this latter condition the peptic and intestinal glands do not perform their normal functions; this absence of intestinal glandular secretions is one of the main factors resulting in constipation.

Fifth.—When water is not given to an infant it frequently suffers with constipation.

Anatomical Changes.—Jacobi says: "The embryonic intestine is formed in separate divisions. There is no ascending colon up to the fourth or fifth month of fœtal life. It is very short in the mature new-born. Despite this, the large intestine of the mature fœtus is longer in proportion than that of the adult. It is three times as long as the body of the fœtus, while it is only twice as long in the adult. There is the same disproportion with regard to the length of the small intestine. The small intestine of the fœtus in the ninth month is twelve times as long as its body. The small intestine of the adult is only eight times as long as the body."

The colon ascendens being very short, the surplus of length, particularly as the transverse colon also is not long, belongs to the descending colon, and especially to the sigmoid flexure. Drandt found it between 8 and 24 centimeters in length, averaging from 14 to 20 centimeters. Jacobi saw a case in which it was 30 centimeters long.

As the pelvis is very narrow, the great length of the lower part of the large intestine is the cause of multiple flexures, instead of the single sigmoid flexure of the adult. Thus it is that, now and then, two or even three flexures are found, and to such an extent that one of them may be found to extend as far as the right side of the pelvis. Cruveilhier and Sappey speak of this position of the lower part of the intestine in the right side of the pelvis as an anomaly. Huguier finds it on the right side of the body in the majority of cases. Others only occasionally, although they admit the great length of the sigmoid flexure. In common with Huguier, who even proposes to operate for artificial anus in the right side, Jacobi found one of the flexures on the right side many times.

The great length of the large intestine and the multiplicity of its flexures are of great functional importance. At all events, they retard the movement of the intestinal contents, facilitate the absorption of fluids, and thus the fæces are rendered solid. When this length is developed to an unusual extent, constipation is the natural result. In the *American Journal of Obstetrics*, August, 1869, Jacobi described two cases in which the descending colon was so long that the diagnosis of imperforate rectum was made. In one of them the operation for artificial anus was performed.[1] "Such cases and such errors are certainly very rare; still there are those in which normal anatomical conditions will lead to incidents of great pathological importance."

Records of *post-mortem* observations made by Dr. T. C. Martin[2] prove that the muscular development of the adult rectum and lower sigmoid is plainly apparent, and that a *deficient muscularity* is observable in the infant specimens. In the infant gut the intrinsic power of peristalsis is not present in that degree necessary to it as a competent expulsory factor.

The meso-peritoneum of these parts in the adult is, relatively, very considerably shorter than that in the infant. The adult gut is slightly tortuous; that of the infant is much angulated. Mobility and angulation of the infant gut conspire to obstruct the passage of formed fæces.

The rectal valve appears to bear the same proportion to the gut in both adult and infant, but when the difference in muscular development in the two is noticed the disproportionate great resistance of the valve in the infant rectum becomes an obvious fact.

Systemic Causes.—Incomplete peristalsis, such as exists in the rachitic debility of the muscular layer, in the muscular debility dependent upon sedentary habits and peritonitis, intestinal atrophy, and hydrocephalus.

Mechanical Obstruction.—Cystic tumors in the intestine. There is, further, intussusception and twisting of the intestine, incarcerated hernia, even umbilical hernia, hardened fæces, and imperforations.

In all these cases the diagnosis should not be made without manual examination. In most of the cases the abdomen is inflated, though it be painless. The fæces come away in small, hard lumps or in large masses. The liver and spleen are displaced. The liver may be so turned that a part of its posterior surface comes forward. The abdominal veins are enlarged

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[1] For a detailed description see "Concetti Archiv für Kinderheilkunde," vol. xxvii, 1899.

[2] "A Study of the Difficulties of Defecation in Infants," by Dr. T. C. Martin, read at the forty-eighth annual meeting of the American Medical Association, June 4, 1897.

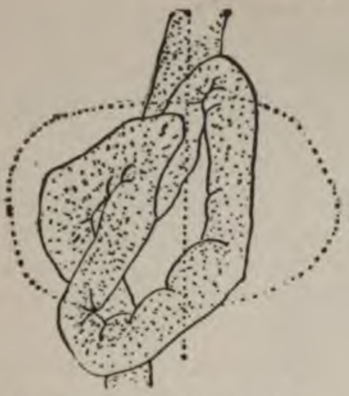

Fig. 75.—Ascending Position.

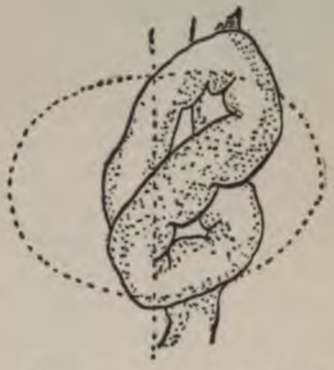

Fig. 76.—Ascending Position.

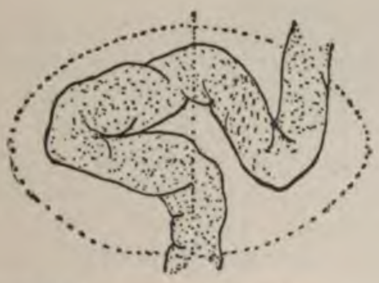

Fig. 77.—Transverse Position.

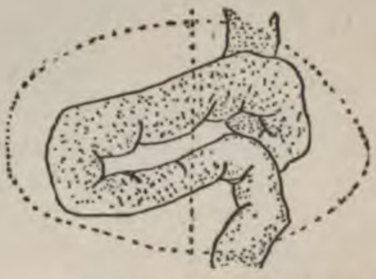

Fig. 78.—Transverse Position.

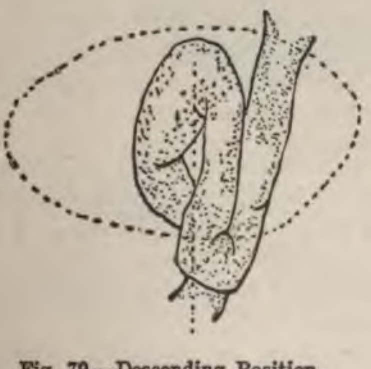

Fig. 79.—Descending Position.

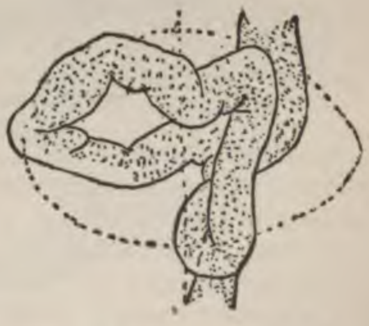

Fig. 80.—Descending Position.

Illustrations of the various types of abnormality of the sigmoid flexure, which are the source of habitual constipation in Infants. (After Marfan & Neter.)

to such an extent that they form circles around the umbilicus, similar to what is seen in hepatic cirrhosis. These children lose their appetite, sometimes vomit, and the irritation produced by the hardened masses in the intestinal canal may be such as to finally result in diarrhœa, which, however, is not always sufficient to empty the tract.

There is, besides, an apparent constipation, which should not be mistaken for any of the above varieties. Now and then a child will appear to be constipated, have a movement every two or three days, and at the same time the amount of fæces discharged is very small. This apparent constipation is seen in very young infants rather than in those of more advanced age. Such children are emaciated, sometimes atrophic. They appear to be constipated because of lack of food, and not infrequently this apparent constipation is relieved by a sufficient amount of nourishment.

As there is frequently a large excess of acid in the intestine, magnesia with or without rhubarb, will frequently relieve the acidity and cause a movement of the bowels.

In the chapter on "Cream" I have already spoken of the deficiency of fat, which is one of the most frequent causes of constipation. Hence, in an infant nursing at the breast it is wise to give the child a teaspoonful of raw cream immediately before taking the breast to correct the constipation. Cream consists of so much fat that in this manner we add fat directly to our food. This is the secret of success attained by some authors when they advise giving codliver-oil, butter, or olive-oil to very young children. Each one desires to remedy the deficiency of fat in his own particular manner.

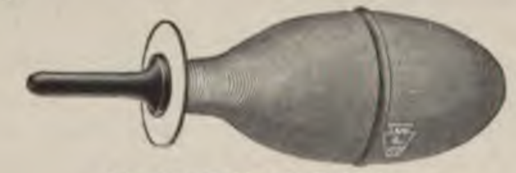

Fig. 81.—Rubber Bulb Syringe.

Symptoms.—In older children, headaches, restlessness, and occasionally abdominal pains are complained of. *I have frequently seen high temperature caused by constipation,* which temperature disappeared soon after the evacuation. Restlessness at night, continued crying in young infants, with the legs drawn up on the abdomen, and fretfulness indicate colicky pains, frequently the result of constipation.

Treatment.—*Immediate Relief (Removal of Scybala):* Hardened round balls or fragments of fæces will frequently be caused when the stool remains very long in the colon, or when the sigmoid flexure has an unusual length; in such instances the injection of either $^1/_2$ pint of lukewarm sweet oil or glycerine will soften these scybala and aid in their expulsion.

At times these balls will be as hard as marbles, and may require the aid of a small scoop (the handle of a teaspoon will do) to aid in their removal.

Enema.—A rule that I have always followed, and one that I lay stress upon, is never to allow a child to retire at night without having had a movement of the bowels during the day. The reason for this is plain; not only will the accumulated fæces and gas cause flatulence, colic, and uneasiness, but this constant distention of the bowels will dilate the intestines to such a degree that frequently a permanent pendulous belly remains.

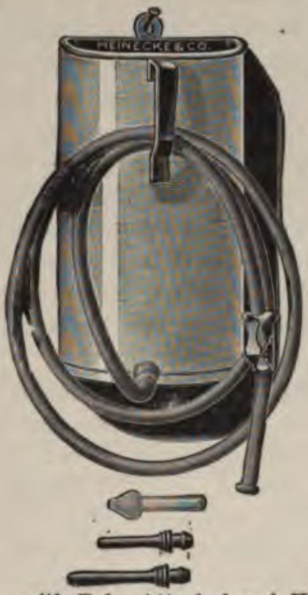

Fig. 82.—Irrigator, with Tube Attached and Hard Rubber Points.

My plan is to order an injection of a half-tumbler of ordinary glycerine mixed with a pint of warm water—temperature, 100° F.—and to allow this quantity to flow into the rectum by using a fountain-syringe, the end of which has the smallest infants' rectal nozzle. In this manner we have a rapid emptying of the rectum and colon, and can be assured of temporary and, possibly, permanent relief. It is not absolutely vital to use glycerine and water, for a similar result can be obtained if we make soap-water by rubbing up Castile or glycerine soap in a pint of warm water.

Fig. 83.—Soft Rubber Rectal Tube for Irrigating the Colon.

Continued Use of Enema.—In obstinate cases it is well to slip a soft-rubber rectal tube over the nozzle, and, having anointed the rubber tube with vaseline or glycerine, the same can be pushed slowly into the rectum, then allow about half a pint of water to flow into the rectum, which will distend it gradually, and, by simply pushing the tube farther into the colon, we can allow the balance of 1 pint or more to flow directly into the colon. The continued use (daily) of these enemas is not fraught with danger; on the contrary, these rectal injections can be used for months. In safe hands, if the mother or nurse is intelligent, there should be not only no injury, but positive good, from their continued use.

Use of Cold Water.—The injection of cold water through a soft flexible catheter or with the aid of a rectal tube acts as an excellent tonic. This injection repeated once a day should be practiced for a long time. If we can teach the child to retain the cold water so much the better. The stimulus of the cold water is especially valuable when constipation is due to chronic colitis associated with catarrh.

Suppositories.—Among those most commonly used are suppositories of the glycerine and gluten type.[1] Most suppositories in the market are entirely too large, and frequently must be cut into halves and quarters. The suppository made by John A. Wyeth & Co. has served the author very well. It should be distinctly understood that a suppository is to be used in the evening for the same relief as we desire from the injection or enema previously mentioned. Neither the suppository nor the injection should be used with the idea of curing a constipation.

Hygienic Treatment.—We should insist on proper ventilation of a child's sleeping-room at night, and it is, therefore, advised that the window be left open a few inches. This is not fraught with danger; on the contrary, it is healthful and beneficial to allow children to play in the open air all day, and naturally to shut them up in poorly ventilated apartments at night is simply inviting both throat and lung trouble. In addition to proper ventilation, bathing in cool water or lukewarm water, followed by an abdominal spray or a douche directed against the stomach and bowels, will be found advantageous in the correction of this ailment. Following the bath, friction with a good, coarse, Turkish towel will be found useful. My preference has always been for a lukewarm bath, followed by a cold douche for a few moments, every morning, and then to have the child properly rubbed until the skin is reddened with a Turkish towel, followed by massage with oil or vaseline.

Mechanical Treatment.—*Exercise:* What massage is for a young infant exercise is for an older child. Thus, it is apparent that atonic conditions can best be relieved by combining the dietetic and medicinal treatment with out-of-door exercise. Children should be permitted to romp about and walk and play out of doors, but not to a point approaching fatigue. Older children will find bicycle exercise or horseback riding decidedly beneficial. It is important, however, to regulate the amount of such exercise, and thus it is the physician's duty to tell the mother or nurse just how *long a child should be permitted to exercise.* It would seem that one-half hour twice a day is ample to arrive at beneficial results. Over-indulgence in such sports will frequently result in rupture and produce heart strain. In cardiac lesions, in asthmatic conditions, if children suffer with whooping-cough, and in tuberculous conditions, such exercises must not be allowed.

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[1] Gluten suppositories are made by the Health Food Company, of New York City.

Massage.—Continued kneading of the abdomen with the aid of vaseline or oil will be found serviceable, and, if properly done, will provoke an action of the bowel. Thus it is that rubbing the abdomen with castor-oil has frequently been recommended in the treatment of constipation; the effect supposed to be due to the castor-oil is, in reality, due to the massage, and to nothing else. When vibratory massage is used, it should be continued from five to ten minutes every day for one month. This will certainly aid and stimulate peristalsis, and ultimately tone the muscles and cure the constipation.

Method of Performing Massage.—The hands are gently placed on the right side of the abdomen at about the ileo-cæcal region. Gentle pressure should be made, otherwise the abdominal muscles will be tense. Commence each stroke of the massage with gentle pressure and utilize each inspiration for firmer and firmer pressure. The same method of palpation which is employed for the diagnosis of a tumor in the deep tissues should be employed. After firm pressure has been made, we can then gradually massage by a rotary movement, first the ascending colon, continue over the transverse colon, and finally over the descending colon and rectum. Hardened scybala can frequently be felt in the region of the cæcum and can be propelled by this mechanical treatment through the various portions of the colon to the rectum.

Length of Time Required for Each Massage.—From five to ten minutes every morning and evening can be continued for several weeks. If improvement is noted, then less frequent treatment is required. To be successful, several months of treatment may be necessary in obstinate cases. We must persist in stimulating the peristaltic waves regularly and not be disappointed if immediate results are not secured. My plan has always been to inform the parents that I do not expect any success in a chronic constipation which has persisted for months or years, until six months or more have passed.

Electricity.—This is very valuable to stimulate peristalsis. The faradic, galvanic, or static current can be used. For the general practitioner the use of the galvanic current, five to ten cells, is sufficient. The negative pole (cathode) should be applied in the rectum, and the positive pole, which produces peristaltic waves, should be applied over the ascending, descending, and transverse colon. Local contractions result from the negative pole. A gentle faradic current applied over the spine and the abdomen will answer if used for several minutes in the absence of the galvanic current. Galvanic electricity should be used every day; frequently months are required to insure a cure, in conjunction with the medicinal and dietetic treatment.

Dietetic Treatment.—We have previously mentioned the value of cream, and the addition of water for the treatment of constipation. In bottle babies it is well to remember that oatmeal water and sago water should be used when constipation exists. Under no condition should barley or rice be given, as the latter will simply increase the constipation. Older children should be given fruit, baked apples, tamarinds, apricots, peaches, prunes, grapes, and oranges. Buttermilk will be found serviceable, as well as kumyss, for the relief of constipation. Sugar (cane sugar) will be found quite serviceable, when added to water, for the relief of constipation in nursing or bottle-fed babies. Thus, a good plan is to give a small piece of loaf sugar dissolved in water immediately before nursing, and to substitute and use cane sugar instead of milk sugar for bottle-fed babies.

Having regulated the diet and excluded fresh bread, cakes, pies, pastries, macaroni, and other floury foods, we should insist, in children over 2 years of age, on eating all green vegetables with the exception of cabbage, beans, turnips, potatoes, and corn. Thus, celery, spinach, green peas, asparagus, and cauliflower are recommended.

A Drink of Water.—From infancy, when the child is but a few days old, we should make it a rule to give it a drink of water; a very small infant during its first week can be given two to three teaspoonfuls of boiled water during the day. A safe plan is to give this drink of water when it is not time for feeding, and if the child appears restless.

Drug Treatment.—A great many drugs are indicated and contraindicated in the treatment of constipation. The intelligent practitioner does not desire merely one movement of the bowels, brought about by drugs, but seeks rather to use such therapeutic measures as will give a permanent cure. My choice of drugs is the following:—

℞ Ext. cascara sagrada fl.	1 ounce
Glycerine	1 ounce

M. Twenty drops of the above mixture in a teaspoonful of water three times a day, for children about three months old. At the age of six months, double the dose, or 40 drops three times a day. At the age of 1 year a teaspoonful three times a day.

Another valuable preparation is malt extract with cascara, in teaspoonful doses, once or twice a day.

My plan is to give the first dose in the morning before the feeding, and note the result. If the bowels move by noon-time then I discontinue the dose at noon, and give a second dose in the evening. If, however, there is no effect by noon-time, then I continue my second dose, and follow with my third dose in the evening. Thus, it will be apparent that, if one dose answers for the day, then we should discontinue the medicine for that day, but commence again on the following day, and keep up this form of drug treatment until it is apparent that the bowels are not as sluggish in their action as before. Another drug which has been one of my stand-bys for many years is nux vomica. I give 1 drop of the tincture of nux vomica in a teaspoonful of sweetened water three times a day, for an infant up to 1 year of age. Children of 2 years I give 2 drops three times a day. From 3 to 6 years, 3 drops three times a day. Six to 10 years, 4 drops three times a day. Ten to 15 years of age, 5 drops three times a day. Nux vomica is always to be administered on an empty stomach; in other words, before feeding. Another valuable drug is rhubarb in the form of the aromatic syrup of rhubarb. From $^1/_2$ to 1 teaspoonful once or twice a day, repeated every two days, will frequently afford relief.

Powdered rhubarb and magnesia, given in teaspoonful doses to very young children, is one of the best laxatives and antifermentatives that we possess. It is especially indicated for the relief of colic.

Citrate of magnesia, given in wineglassful doses to children over 1 year of age once or twice a day, can also be recommended.

In atonic conditions of the bowels depending on general weakness, strychnine, given in $^1/_{200}$ or $^1/_{100}$-grain doses twice a day, will be found useful. This may or may not be combined with iron.

The infusion of senna leaves is made by boiling a heaping teaspoonful of ordinary senna in a teacupful of boiling water for fifteen minutes, straining, and when cool adding 1 tablespoon of glycerine to 5 tablespoons of this infusion of senna. This quantity to be administered in three doses at intervals of four or five hours. In some instances the addition of syrup of manna will be found advantageous in sweetening the infusion of senna.

Phosphate of soda, in doses of 5 to 15 grains, given in milk with the food, is a mild and sure laxative. A pleasant preparation sold in the shops is known as milk of magnesia. It is a good antacid and laxative when given in doses of $^1/_2$ to 1 teaspoonful.

Certain drugs should not be given. Of these castor-oil may serve as a type. The constipating effect following the use of castor-oil is so well known that this drug is indicated when we wish to cleanse the stomach and bowels and remove stagnant food, as, for example: in fermentative dyspepsia accompanied by diarrhœa. Thus, we not only have an effective movement, but a constipating effect following the same. The use of drastic cathartics—such as scammony, elaterin, or podophyllin—should not be thought of in the treatment of infants and children. Very rarely do I use aloes, owing to its offensive taste. It is understood that calomel is only to be given when we wish to cleanse and produce an antiseptic effect in the intestine; for the treatment of constipation *per se,* calomel is entirely out of place.

INTESTINAL COLIC (INTESTINAL NEURALGIA: ENTERALGIA).

Intestinal colic consists of pain which is paroxysmal in character, located in the bowel and without evidence of inflammation.

Symptoms.—Colic is one of the most frequent causes of crying in children. They not only cry loudly, but will *suddenly shriek,* and when put to sleep will awaken with a sudden start, and cry loudly. The legs are usually flexed or they will move their legs back and forth, or up and down. They will seem to bend the body on itself. These attacks are usually associated with constipation; hence, it is a good plan, when the child is restless and utters a painful cry, to see if the bowels have moved. It is well known that this colic may be as well associated with diarrhœa. The origin of all colic is certainly the stomach. When dyspeptic conditions, arising from undigested particles of food in the stomach, exist, then fermentation, resulting in gas formation, is the result. Colic is frequently but incorrectly known by the terms of "meteorismus" or "tympanites," but in the latter conditions the abdomen is greatly distended, and there is a permanent enlargement of it. Borborygmus (rumbling sounds) can usually be made out, if the ear is applied to the abdomen. The vast majority of cases of colic have their seat in the intestine, and can be relieved very quickly.

Causes.—Worms (ascarides) have been known to cause colic. When there is a general loss of tone on the part of the muscular layers in the walls of the intestine, colic will frequently result. Jacobi believes that colic can be caused by chronic peritonitis resulting in adhesions or local changes in the walls of the intestine that will produce local contractions or dilatations.

Excess of Sugar.—When colic is caused by an excess of sugar, there will be considerable eructations of gas, and, frequently, small quantities of food will be regurgitated.

The stools, when an excess of sugar is given, are thin and greenish, smell very acid, and usually produce a reddened excoriation of the buttocks around the anus.

When children show a tendency to the development of gas and have constant recurring colic, my plan is to discontinue the use of sugar until such time as this fermentation is absent. To sweeten the food I use small, saccharine tablets, 1 grain being ample to sweeten 1 pint of food. When there is a tendency to constipation, it is possible not only to sweeten the food, but also to modify this constipation by adding 1 teaspoonful of pure glycerine to each bottle of food prepared. A teaspoonful of malt-extract will sweeten and also relieve constipation.

Excess of Proteids.[1]—A careful observation of the stools would easily show whether the albuminoids are in excess, for they are usually present in the form of curds. This condition is usually associated with constipation, and the indication would be to cut down the quantity of proteid administered.

Undigested curds due to excess of proteids and excessive fats are a frequent cause of colic. Irregular feeding, too frequent or over-feeding, are the commoner causes. The majority of cases of colic are seen in bottle-fed babies. This is usually due to milk which is too acid or superheated milk, as in prolonged sterilization. In the latter manner of treating milk the casein is rendered very difficult to digest, and frequently results in intestinal fermentation, causing colic.

Colic in Breast-fed Babies.—If colostrum continues and the milk does not assume normal conditions, colic may result. Colic is frequently seen during menstruation of nursing women. Pregnancy occurring during lactation usually causes colic.

Differential Diagnosis.—We must be extremely careful to exclude the pain of intussusception, the pain from gall-stones, the pain of appendicitis, or the pain of a strangulated hernia. The absence of fever, the disappearance of the symptoms by the regulation of the diet, the flushing of the colon to remove the offending cheesy *débris,* will materially aid in strengthening the diagnosis.

Infant J., eleven months old, bottle-fed, cried and suffered with pain from one to two hours after taking his feeding. The temperature was 101° F., rarely higher. The infant would scream for a few minutes at a time, then expel flatus per rectum, and be apparently relieved. He would be cheerful and play for a short time when another paroxysm of pain would come on and start him screaming again, until flatus was expelled. Relief was immediately given when the rectum and colon were flushed with warm water to which several ounces of glycerine had been added, temperature, 115° F. Anti-fermentatives, such as rhubarb and soda mixture, or several grains of calcined magnesia, invariably relieved the child and prevented intestinal fermentation.

The treatment of colic is simple when the cause is known. The quickest method of relieving colic is to give an enema of soap and water or of warm chamomile tea. I usually take an ounce of German chamomile flowers and steep them in a quart of boiling water from ten to fifteen minutes, then strain. The injection is to be given in the same manner as has been described in detail in the chapter on "Constipation." My method is to allow 1 or 2 pints of chamomile tea at a temperature of 100° to 110° F. (no hotter) to flow slowly into the rectum, and by all means the colon. When the colon is thoroughly flushed with this warm tea, and emptied of its fæces, it is usual for the attack of colic to cease. In addition to washing the colon, it is a good plan to apply a small bag of either chamomile flowers or slippery elm bark, or ground flaxseed meal. To do this, I make a bag of cheese-cloth, capable of holding from 1 to 2 ounces, and then fill it with one of the above-mentioned ingredients; sew the bag shut when filled, and heat it before applying to the abdomen. Several of these bags can be made and kept in readiness, so that they can be applied quickly. It is a good plan to have one heating on the stove, while another is on the abdomen. These little bags are very soothing, and we are frequently rewarded by having the infant not only expel wind shortly after they are applied, but also fall asleep.

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[1] Read also article on "Proteid Indigestion," in chapter on "Breast Feeding," Part III.

Massage.—During an attack of colic gentle massage with warm sweet-oil or melted vaseline or lard will certainly be very comforting to the child. My plan is to take a bottle of oil, warm it by placing it in a kettle of warm water, and then to pour it on the abdomen. The distended abdomen should then be thoroughly kneaded until the gas is expelled. Then the warm applications mentioned above can be applied.

Drug Treatment.—If the colic originated from a fermentative dyspepsia, then treatment must be directed to the stomach. For this purpose antifermentatives, like the mistura rhei et sodæ, should be given in doses of $^1/_2$ to 1 teaspoonful, diluted with water, every two or three hours until there is a thorough evacuation. Very good results will be found, after the bowel has been cleaned with the quart of chamomile tea previously mentioned, by administering from 5 to 10 grains of bismuth; I prefer to use betanaphtol or the subnitrate; $^1/_2$-grain doses of resorcin will also be found useful. Paregoric in doses of 15 drops to $^1/_2$ teaspoonful should be administered with great caution to children of six months or older. It is understood that no physician will forget the danger of giving repeated doses of paregoric or permitting the same to be administered by incompetent people not aware of the dangers of the drug habit. The author has not only seen distinct opium poisoning follow the use of paregoric, but has also had occasion to see the distinct opium habit in very young children. This was reported by me in a paper read before the New York County Medical Society, January 22, 1894, which was published *in extenso* in the *Medical Record* of February 17, 1894. For an infant during the first few months, it is hardly safe to give more than 5 drops of paregoric, repeated in an hour if there is no relief. Another drug that has served the author very well is Hoffmann's anodyne in doses of from 1 to 5 drops, repeated in an hour if necessary. For an infant up to two months 1 drop per dose; from two to four months, 2 drops per dose; four to six months, 3 drops;

six to nine months and until 1 year of age, 4 drops; children from 1 to 2 years, 5 drops. This is to be given in a teaspoonful of sterilized water. Another valuable drug, and one that is to be given cautiously, and in the same doses as Hoffmann's anodyne, is spirits of chloroform; never should more than from 1 to 4 drops be given to a child up to 1 year of age, and younger children less in proportion. I cannot favor the administration of nauseating or foul-smelling drugs, such as asafœtida. We must try to cater to an infant's taste, especially so when in pain.

An excellent preparation to relieve colic is calcined magnesia, or milk of magnesia, made by Phillips.[1] Hare's "System of Medicine" contains an article by Stewart advocating its use. It has served the writer very well especially in young infants, where acidity was prevalent. A half-teaspoonful several times a day was enough in some cases, while others required several teaspoonfuls during the day. It is valuable where constipation exists, and can be added to the bottle of food.

Borborygmus (Rumbling Noises).—Children frequently have rumbling noises which are troublesome. A girl recently under treatment of the writer had this trouble for several years. The noises were so loud that they could be heard in the adjoining room. They were aggravated by deep inspiration. Frequently eructations of gas would afford temporary relief. This condition is met with in ectasia or in ptosis of the stomach. In the case of gastroptosis above mentioned, a tight-fitting abdominal bandage afforded relief. Anti-fermentatives: Milk of magnesia in teaspoonful doses is beneficial; powdered charcoal in 2 to 5-grain doses is also useful when taken shortly before meals.

ACUTE INTESTINAL INDIGESTION.

This disturbance originates in the duodenum. As a rule that which the laity describes as a "bilious attack" is an acute or chronic condition which originates from food which has not been properly digested.

Symptoms.—This condition is very rare in young infants, but is frequently met with in later childhood. Headache is a prominent symptom, associated with pain in the abdomen and usually sour eructations. The breath is foul, the tongue is coated. Sometimes undigested particles of food will be seen in the stools (lientery). The temperature ranges between 100° and 101° F., rarely higher. Either diarrhœa or constipation may be present. If very little bile is passed the stools may be clay-colored. Rarely jaundice is present.

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[1] *Philips's Milk of Magnesia—Hydrated Oxide of Magnesium* (MgH_2O_2).—A teaspoonful of Philips's Milk of Magnesia is equivalent in acid neutralizing power to 4 ounces of lime water, or 10 grains of sodium bicarbonate. It will neutralize nearly twice its volume of lemon juice. Each fluidounce represents 24 grains of magnesium hydrate. Dose: From a teaspoonful to a tablespoonful, according to age—increased or diminished at discretion. Dilute with equal quantity or more of water.

The prognosis is always good.

Treatment.—Remove the cause if possible. It is necessary to study the diet of the child and exclude undigestible food which might cause these attacks. During an acute attack 5 drops of peppermint in a tablespoonful of hot water, or 3 drops of Hoffmann's anodyne may be given to relieve colicky pains.

In an article in *Pediatrics* on "Gastro-intestinal Indigestion in Children," Dr. S. Henry Dessau, of New York, says that when spigelia is added in moderate doses to the tonic-laxative as in the formula given below, it appears to exercise a most beneficial influence in arresting the immoderate secretion of mucus, diminishing flatulence, relieving the sighing respiration, and removing the many nervous phenomena.

The formula he employs, which may be called a working basis, is composed of:—

℞ Ext. spigelia, fld.	2 fluidrachms
Ext. senna, fld.	2 fluidrachms
Ext. cascara, fld.:	1 fluidrachm
Tr. nux vomica	1 fluidrachm
Tr. cinchona comp.	4 fluidrachms
Syr. sarsaparilla comp., ad	2 fluid ounces

M. Sig.: 1 drachm ter in die.

The diet should exclude milk during the acute attack for at least twelve to twenty-four hours, and thin soups or broths and weak tea can be given instead.

Chronic Intestinal Indigestion (Duodenal Catarrh: Mucus Disease).

This condition is always associated with a chronic derangement of the stomach. It is usually a functional disturbance and is one of the most difficult conditions to treat in children.

Etiology.—This is usually obscure, although it follows exhaustive diseases such as typhoid, diphtheria, or other infectious diseases. The most frequent cause is improper food, unsuited for the age and development of the child.

Symptoms. — As a rule gastro-enteritis precedes this condition for months, in each and every case. The stool shows a tendency to looseness and mucus is found covering the fæces. The mucus is seen in shreds and masses at times covering the fæcal matter. Such children are usually backward in development. They are very irritable, tire easily, and lose in weight.

As a rule the abdomen is distended. There is no fever. The appetite varies and is poor. The liver does not functionate properly, and in some cases very little bile is secreted, giving rise to clay-colored stools. The skin is dry.

Diagnosis.—The only condition which might resemble chronic intestinal indigestion is general tuberculosis. The absence of cough, the absence of fever, and the absence of physical signs in the lungs should help to exclude tuberculosis. The diagnosis will be more readily made when previous gastric or gastro-intestinal derangements are taken into account.

Prognosis.—This is usually good, even though these attacks may extend over years. If, however, rapid emaciation and general weakening of the heart exists, the prognosis becomes grave.

Treatment.—*Dietetic Treatment:* This is the most important part of the treatment and requires very careful consideration. Excessive fats and sugars should be avoided. Light meals rather than heavy should be ordered. Give predigested food if required. Whey, skimmed milk, zoolak, thin cocoa, chicken broth, beef broth, clam broth, soft-boiled egg, fish, oysters, raw scraped steak, apple sauce, baked apple, to be varied with other well stewed fruit, should be given. Avoid all fresh bread. Rusk (zwieback) may be given. Give all green vegetables in season. Avoid all heavy cakes, pies, and puddings. If this light diet is continued for several months great improvement will be noted. The últimate care will depend on restricting the diet to nutritious and very easily digested food.

Medicinal Treatment.—Give nux vomica, 1 to 3 drops, three times a day, before meals. Or:—

℞ Acid hydrochlor. dilut.................................... 1 ounce
Five minims three times a day, after meals.

Pay careful attention to the bowels; give a laxative if necessary. If severe anæmia exists then give:—

℞ Tr. ferri acet. æth.. 1 ounce
Ten drops, three times a day. One hour after meals.

This has been found to be the best form of iron in the management of this condition.

A girl, 8 years old, was breast-fed in infancy and appeared apparently healthy. Her dentition, walking, and talking normally developed about the end of the first year. During the second year she suffered with measles. When 4 years old she had an attack of acute milk poisoning, resulting in gastro-enteritis. From this time on she has not been in good health. She complained of headaches, nausea, and anorexia. She has a foul breath, and is very anæmic. She does not seem to thrive. The slightest imprudence in eating causes gastric symptoms. Her abdomen is large and gas is frequently expelled per rectum. She is always languid. The temperature is normal, the pulse-rate feeble, it usually ranges between 90 and

100. She does not sleep well, talks in her sleep and tosses about. Under a rigid diet, excluding pure milk, and giving diluted milk, whey, thin soups, soft boiled eggs, and fruit, improvement was noted. The interval of feeding was restricted to five hours, so that the child was fed three times a day. A daily movement of the bowels was insisted upon. One half-teaspoonful of phosphate of soda in a teacup of warm water was given when the child was constipated. Five drops of acid hydrochloric dilute was given three times a day. The case improved and the child is in a good condition to-day.

ACUTE MILK INFECTION (CHOLERIFORM DIARRHŒA: CHOLERA INFANTUM).[1]

In bottle-fed children, especially among the poorer classes, acute milk poisoning is frequently seen during the summer months. This is due mainly to the chemical or toxic product developed in the milk. The heat of the summer rapidly decomposes milk, and large quantities of bacteria multiply and generate their toxic products. When such milk is fed to infants they show the effect of the toxin very rapidly. Park found that when milk was first received from the farms it contained from 10,000 to 20,000 bacteria in each cubic centimeter. On the second day the bacteria had so increased that there was between 10,000,000 to 30,000,000 per cubic centimeter.

Langermann[2] found that a sterilized milk mixture which contained roughly from 30 to 40 micro-organisms when taken by the infant, contained from 4000 to 6000 one and one-half hours later when taken from the infant's stomach.

In healthy infants nursed at the breast he found *the same number of bacteria* in the stomach contents as he did in the stomach contents of infants taking sterilized milk.

The stomach contents of infants suffering with dyspepsia contained many more organisms that that of healthy children.

He found that hydrochloric acid acts as an anti-fermentative. Thus it appears from his experiments that numerous organisms are present and *flourish in the stomach of infants under normal conditions,* being derived from the food and also from the mouth.

Summer diseases, particularly entero-colitis and cholera infantum, will appear just as readily in breast-fed children who are improperly managed as in bottle-fed children. By improperly fed children I mean *too frequent feeding* or the feeding of breast-milk which is unsuited for the infant, because of *excessive fats* or an *excess of proteids.* This has already been described in detail in the chapters on "Breast and Bottle Feeding."

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[1] The bacteriology is described in the following chapter on "Subacute Milk Infection."

[2] Jahrbuch für Kinderheilkunde, Band xxxv, Heft 1 and 2, p. 88.

Pathology.—There is extreme emaciation of the entire body affecting muscles and fat. The fontanel is depressed. The eyes are sunken. The elasticity of the skin is gradually lost, the skin hangs in loose folds. The body resembles an advanced form of tuberculosis. Minute hæmorrhages are found associated with intense congestion in the stomach and intestines. The evidence of catarrh is everywhere seen. There is an excessive secretion of mucus in the larger intestine; in the colon ulcers will be found.

Ashby and Wright describe a general distention of the net-work of the capillaries situated in the mucous membrane of the intestine. The same condition is found in the submucosa, in the villi, and between the tubules and crypts of Lieberkuhn. "The central portions of the solitary glands are softened, or the softened portions having been discharged, the remains of the glands appear as sharply cut ulcers, although the sinuses of the brain are found distended with blood. Occasionally cerebral anæmia may exist." Meningitis is rare.

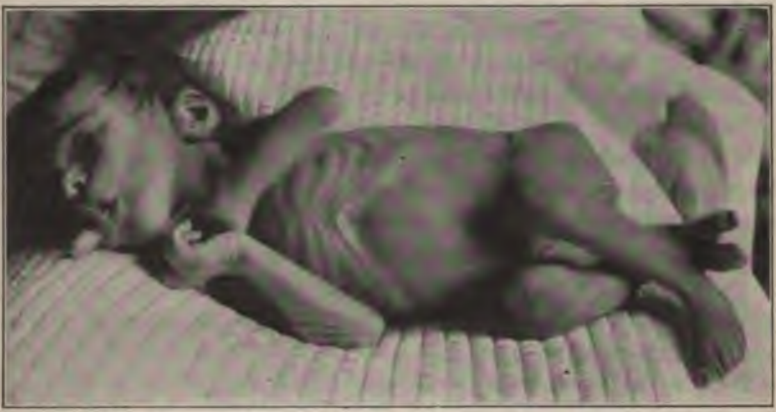

Fig. 84.—A Case of Acute Milk Poisoning Having Vomiting, Diarrhœa, Mucous and Bloody Stools, General Emaciation, Acute Cholera Infantum and Dysentery. (Original.)

Causes.—Two varieties of micro-organisms are constantly present in the intestinal tract of healthy children. They are described in detail in the article on "Bacteria of the Intestine" and also in my book on "Infant Feeding in Health and Disease," page 39, Third Edition. We rarely see this condition in breast-fed children, unless there is present a subnormal condition due to atmospheric conditions. Overfeeding and irregular feeding also invite this condition.

See article published by me in the Medical Record, July 13, 1895, entitled "The Treatment of Summer Complaint, or Gastro-enteritis Catarrhalis Acuta, Including Cholera Infantum in Children."

The etiological factors can be briefly outlined as follows:—

1. Food, improper quantity and quality of the same, be it breast-milk or hand-feeding. It is a well-known fact, cited by Jacobi among others, that breast-milk can also cause this disease.

2. The most frequent cause is certainly improper bottle-feeding, wherein food unsuited to the infant's digestive abilities is continued, in spite of Nature's efforts to warn us, as frequently manifested by either vomiting or diarrhœa, or both.

3. Milk from mothers suffering with tuberculosis or syphilis. Pregnant women, menstruating and all anæmic women, secrete such poor milk that gastro-enteric derangements are exceedingly common.

4. The influence of the weather on digestion, especially the extreme heat of summer.

5. Improper disinfection of the nipples after feeding, and consequent decomposition and formation of micro-organisms, causing infection; all unsanitary conditions deleterious to the healthy child.

An important point to remember is that very many diseases have symptoms resembling cholera infantum and must be carefully differentiated; for example, typhoid fever occurring in midsummer may simulate this disease and give rise to symptoms which greatly resemble cholera infantum. We occasionally see children having diarrhœa, vomiting, and fever in whom on palpation a tenderness in the ileo-cæcal region can be palpated. Such cases may have appendicitis and still show all the symptoms of cholera infantum.

From *reliable statistics* in Norway the mortality ranges from 8.5 to 10.5 (breast-feeding only), while in Bavaria the mortality is about 30 per cent. (mostly bottle-feeding), children being brought up chiefly on farinaceous foods. Out of 400 deaths of children from summer diarrhœa, Minaret, in Bavaria, observed 96 per cent. were artificially fed.

TABLE No. 54.—*Population, Deaths and Death-Rates of Children under Five Years of Age, During June, July and August, from 1891 to 1903 in (old) New York City.*

Year.	Population.	Deaths.	Death-Rate.
1891	188,703	5,945	126.0
1892	194,214	6,612	136.1
1893	199,886	5,892	117.9
1894	205,723	5,788	112.5
1895	212,983	6,183	116.1
1896	218,444	5,671	103.8
1897	222,387	5,041	90.7
1898	226,515	5,047	89.1
1899	230,842	4,689	81.2
1900	235,386	4,562	77.5
1901	240,166	4,642	77.3
1902	245,201	4,387	71.6
1903	250,518	4,087	64.5

TABLE NO. 55.—*Population, Deaths and Death-Rates of Children under Five Years of Age, from 1891 to 1903 in (old) New York City.*

Year.	Population.	Deaths.	Death-Rate.
1891	188,703	18,224	96.6
1892	194,214	18,684	96.2
1893	199.886	17,865	89.4
1894	205,723	17,558	85.3
1895	212,983	18,221	85.6
1896	218,444	16,807	76.9
1897	222,387	15,395	69.2
1898	226,515	15,591	68.8
1899	230,842	14,391	62.3
1900	235,386	15,648	66.5
1901	240,166	14,809	61.6
1902	245,201	15,019	61.2
1903	250,518	13,741	54.8

The above populations previous to 1896 represent estimates based on the proportion of children under 5 to total population, as existed at the census of 1895, to wit: 11.37 per cent.; and from 1896 on, to the proportion as existed at the census of 1900, to wit: 11.46 per cent.

The author desires to thankfully acknowledge the kindness of Dr. William H. Guilfoy, of New York Health Department, for furnishing the above statistics.

Harry G., ten months old, bottle-fed, was brought to me with a history of vomiting, high fever, and diarrhœa. The temperature was 104° F. The stool was green and contained mucus and curds, and had a very fœtid odor. The stools were as frequent as twenty in twenty-four hours. There was a great deal of flatulence, the abdomen was distended, and there was constant tenesmus. The mouth was dry, the tongue had a whitish fur coating, and in the mouth small patches of stomatitis could be seen. The tongue protruded constantly and when liquids were given they were taken ravenously. The mother stated that ordinary grocer's milk had been used, and that she believed the milk had turned sour "after a thunderstorm." The diagnosis of acute milk infection was made. The stomach was washed by the use of 1 quart of saline solution. Two drachms of castor oil was ordered, and one hour later the rectum and colon were flushed with 1 quart of chamomile tea. All milk was stopped. No food was given for six hours. A bland diet of sweetened rice water and whey was then given in quantities of 4 ounces every two hours. As a stimulant, 15 drops of whisky was given with $^1/_{100}$ grain of strychnine every three hours. The child improved, and three days later 1 ounce of milk, with 7 ounces of rice water, was given every three hours. The milk was gradually increased every other day, and the rice water decreased. The child recovered.

Symptoms.—The two cardinal symptoms are *(a)* vomiting, *(b)* diarrhœa. In some instances the first evidence of this infection will be fever. The temperature may be as high as 103° to 105° F. There will be intense thirst. There is no appetite. The infant will refuse its bottle, and if forced to take it will immediately throw it off. Bile, mucus, and sour smelling curd form the bulk of the vomit. The abdomen is usually distended. There is a great deal of flatulence. The stool is watery and greenish in color, with a very foul odor. When the diarrhœa continues for several days, the temperature may become subnormal and the infant's forehead may be covered with a cold, clammy perspiration. The extremities are usually cold. The child will sink very rapidly, owing to the amount of exhaustion. The body is constantly drained by the diarrhœa. Unless the clinical picture is recognized and proper treatment instituted, the infant may sink into a coma and have convulsions, followed by death.

The following case illustrates acute milk poisoning in an infant less than 1 year old. The infant was bottle-fed and received the food daily, modified, from a milk laboratory. This food seemed to agree until the time of the present illness. The child was under the treatment of Dr. John Logan and Dr. J. Martinson, both of New York. The case was seen by me in consultation after several days' illness. The infant was vomiting and had greenish mucus stools. There was severe tenesmus. The infant showed severe prostration and was apparently comatose. The fontanel was sunken. The pulse was very feeble. The circulation was poor and the extremities cold. As no food was retained, in addition to the amount of toxin in the circulation, the heart's action became weaker and weaker. It was very difficult to rouse this child. In spite of high saline colon injections, the child died of exhaustion associated with general toxæmia.

Diagnosis.—The diagnosis of this condition is extremely easy. It is usually aided by the clinical history. The disease usually occurs in summer, although milk poisoning can take place during any time of the year.

Differential Diagnosis.—Sunstroke may sometimes be confounded with cholera infantum, but the continued diarrhœa in cholera infantum, and its history, should aid in eliminating this condition as a factor. Asiatic cholera shows symptoms similar to cholera infantum. The presence of the comma bacillus in the stools will easily establish the presence of Asiatic cholera.

The prognosis depends on the infant, its surroundings, and the amount of infection, and the length of illness. An infant having good vitality and being given a careful diet and stimulation with proper hygenic treatment, certainly has more chance than one left in the city amid poor surroundings with faulty hygiene.

Treatment.—*If the infant is breast-fed* discontinue the breast at least twenty-four hours. During this time rice water, barley water, albumin water, or very weak tea may be given. Diluted coffee is frequently ordered by me when evidence of heart weakness exists. If the acute symptoms of vomiting and diarrhœa have been stopped by appropriate treatment, then the breast may be permitted once every six or eight hours, the alternate feeding to consist of rice or barley water, as previously described. In other words, we must return gradually to milk feeding. If acute symptoms return when the breast-milk is given, then it is a question as to whether or no the breast should be entirely withheld. Whey is a useful substitute when milk is not well borne.

Bottle-fed Infants.—Stop all cows' milk.

A good plan is to feed with intervals of three and four hours between each meal, and if the usual amount of feeding was six or eight ounces, then it is a good plan to give but four or six ounces, of either rice, barley, or farina water. Albumin water, made by adding the white of a raw egg to a wineglassful of sterilized water and a pinch of salt, is very good to allay thirst, besides adding to the nutrition of the child. Ice-cold tea (the ordinary black and green tea mixed) can be given *ad libitum.*

Hygienic Treatment.—Cold bathing or bathing in cold or lukewarm water, to which some sea salt has been added, is very advantageous; the child should be put into the largest and coolest room in the house, the temperature to be from 68° to 75° F. *If sea air is obtainable, then it is wise to remove the child to the seashore, or at least to insist on daily excursions.*

Cold applications to the head and an ice-bag over the fontanel, cold towels changed every fifteen or thirty minutes over the abdomen, will tone up the nervous system in addition to reducing the temperature. I am a decided opponent to antipyretic drugs, and never use antipyrin or phenacetine, but invariably resort to hydropathic measures for the reduction of the temperature. Sponging of the body with alcohol and water is very grateful and refreshing, besides a good antipyretic measure. If cyanosis and cold extremities exist, then it is wise to resort to hot mustard baths to stimulate the circulation.

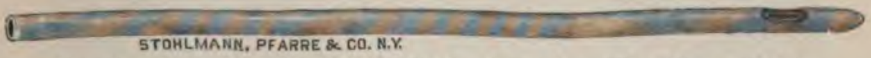

Fig. 85.—Exact Size of Catheter Used for Irrigating a Very Young Infant.

Having noted the various causes of summer diarrhœa, chief among which is improper feeding and its resultant diarrhœa, the first thing to do is to cleanse the stomach and bowels. This can be most readily accomplished by:—

Stomach Washing.—To do this, I take a No. 10 soft flexible (rubber) catheter (No. 8 for a younger infant), having more than one opening, and attach it to either a 2-quart glass irrigator or a 2-quart rubber fountain syringe. It is far better to use rubber tubing and a glass funnel, as we can then easily watch the liquid enter, and it is also more practical, as it can be kept clean more readily. For irrigating the stomach I use the following solution:—

℞ Table salt	**1 teaspoonful**
Boiled water	**1 quart**

The above quantity for one washing, to be used until the gastric contents flow away clear. To introduce the tube it is pushed through the mouth, gently but rapidly against the pharyngeal wall, into the œsophagus, until the stomach is reached. It should not be anointed with oil, as we normally have so much mucus present that we have Nature's own lubrication. Having introduced the tube, I raise the irrigator or funnel or fountain syringe, which has been previously filled with 1 quart of the salt solution mentioned above, and hold the same about one to two feet over the child's head—no higher. The temperature of the water should be between 100° and 105° F. If there is severe irritability of the stomach, or a tendency to nausea and vomiting, then it is a safe plan to attach the catheter to a long tube, ending in a funnel, and using but one-half to one pint of the salt solution, allow it to enter the stomach slowly. We can syphon off the contents of the stomach by lowering the funnel below the

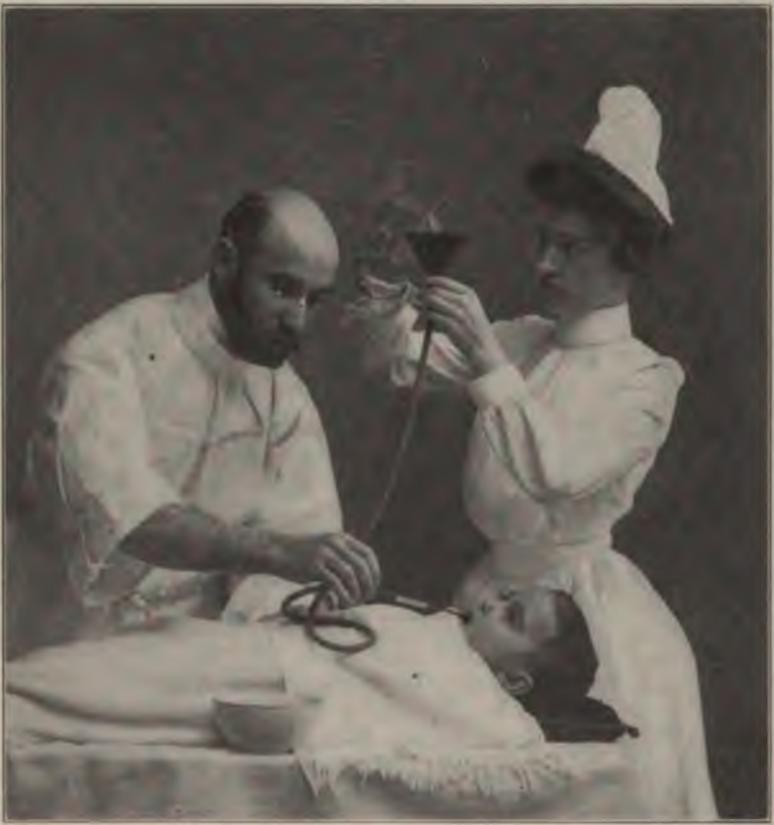

Fig. 86.—Stomach Washing. Introduction of the catheter. (Original.)

level of the stomach. After emptying the same we can again fill the funnel, and allow the salt solution to flow into the stomach; and so this process of syphoning can be repeated until the gastric contents flow away fairly clean.

It is a good plan not to continue the washing of the stomach, unless urgent symptoms of gastric fermentation or possibly vomiting of food call for the same. It is my plan to wait at least one or two days and note the effect of the stomach washing before repeating it.

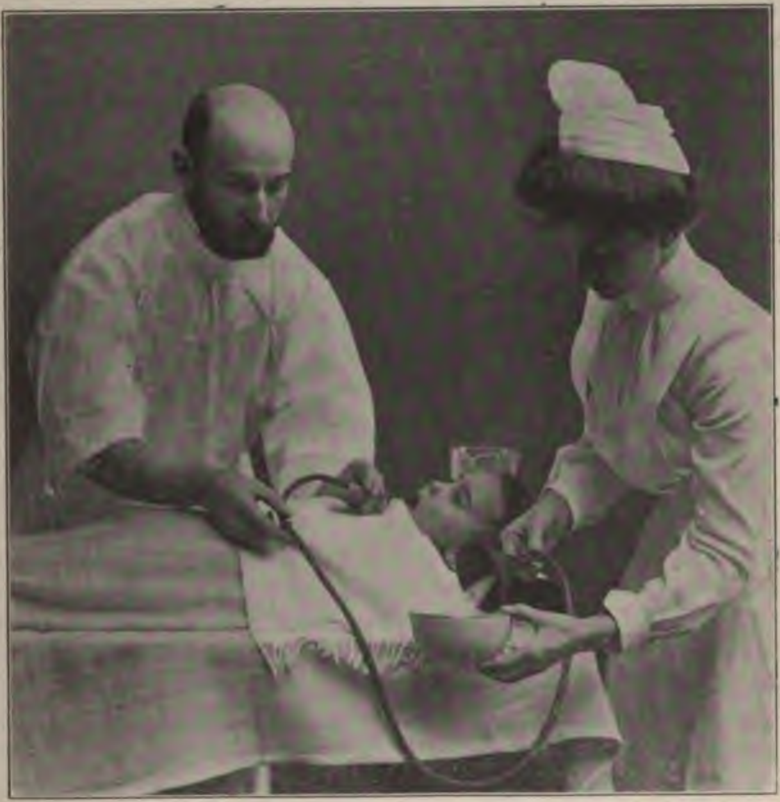

Fig. 87.—Stomach Washing. Syphoning off the gastric contents. (Original.)

Having cleaned the stomach, it is a good plan to prescribe rest, and to insist on leaving the child several hours, without giving food of any kind. I usually order a small quantity of an alkaline water, either Seltzer or Vichy, Apollinaris water, or plain boiled (sterilized) water. A tablespoonful of lime water, several times a day, independent of food, is also advantageous.

In all forms of diarrhœa milk must be discontinued. The details of feeding have already been given.

When we find a decided objection on the part of the patients or their parents to the above method of cleansing the stomach, then we must resort to:—

Drug Treatment.—For this purpose a large dose of calomel, $^1/_4$ of a grain for a child 1 year old, is given every two or three hours, until watery stools are produced, and this is followed on the succeeding day by two or three doses (a teaspoonful each) of castor-oil. The tendency to constipation following a dose of castor-oil makes it a valuable remedy in all forms of diarrhœa. Bismuth is the sovereign remedy; I have used the subcarbonate, subnitrate, salicylate, and betanaphthol bismuth, and find the latter an extremely valuable preparation. In doses of 2 to 5 grains every few hours, mixed with a little boiled water, it not only agrees very well with children, but seems to exert a healing effect in that form of bacillary diarrhœa which is met with in the acute catarrhal gastro-enteritis.

Salol in doses of 1, 2, and 3 grains, for each year respectively, is another valuable remedy; so also is resorcin, in doses of $^1/_4$ to 1 grain for a child 1 year old, three or four times a day. It is advisable not to add sugar for sweetening, but only glycerine; the latter, however, in very small quantities, as it has a tendency to loosen the bowels.

Nitrate of silver in doses of $^1/_{50}$ grain for a child 1 year old, repeated every three or four hours, is valuable in some cases.

Tannalbin and tannigen in doses of from 1 to 10 grains seem to act well in some cases, poorly in others, but are well worth trying in those desperate cases in which we change the drugs, if they are ineffectual.

Hypodermic Medication.—In forms of collapse, where constant diarrhœa has drained the system, it is a good plan when the extremities are cold to give hypodermic injections of 10 to 20 drops of whisky. Sulphuric ether can also be administered hypodermically in the same dose as whisky. Another valuable stimulant is musk; 2 to 3 drops of tincture of musk administered hypodermically every hour will frequently rouse the circulation.

When this form of treatment proves unsuccessful, and the condition of collapse continues, then a good plan is to resort to *hypodermoclysis.* This consists of introducing a long aspirating needle (previously sterilized by boiling) into the loose connective tissue of the abdomen, and allowing several pints of the normal saline solution, containing about 7 $^1/_2$ grains of table salt to a pint of water, temperature 100° F., to flow in subcutaneously. It is remarkable to note how much liquid can be introduced in this manner, and some of the most desperate cases of collapse will respond very rapidly. I have seen children who previous to this injection were pulseless suddenly brighten up, and within a few minutes show a distinct radial pulse. Too much care cannot be bestowed on the sterilization of every part of the apparatus, and the absolute cleanliness of the water to be used for this purpose.

Rectal and Colon Flushing.—It is advisable to irrigate the colon and rectum by placing the child on its left side, introducing a flexible rubber tube *anointed* with carbolized vaseline. Having passed the external sphincter, I invariably allow the water to flow into the rectum in order to balloon the same, and then continue to push the tube beyond the rectum into the colon. A little difficulty is sometimes encountered, owing to the spasmodic contraction of the muscles, but if we wait a short time, using a little patience, the tube can easily be pushed into the colon. The method pursued is the same as described previously in irrigating the stomach, excepting that we do not seek to syphon off the contents of the bowels, but rather allow a pint or a quart of the warm saline solution to flush the bowels, and in this manner wash away as much of the offending *débris* as exists within the bowels. I have frequently used cold water, but I find much greater benefit from the use of a warm solution of the temperature of 105° F.

Besides table-salt solution, a 1 per cent. boracic acid solution can be used, so also can a 1 to 10,000 solution of bichloride of mercury. A solution of 10 grains of tannic acid to a pint can also be used, and a 1 to 1000 solution of nitrate of silver is indicated in other cases.

Some of our cases require irrigation once in twenty-four hours for one week, and others again are so greatly improved after one rectal washing that it is not necessary to resort to it again.

Starch injections, made by adding 2 tablespoonfuls of the ordinary starch to a quart of warm water of a temperature of 105° F., may be given. They are very advantageous, as the colon changes starch into dextrin, which is easily absorbed. Thus not only does the latter cleanse, but it is also nutritious. Large quantities of saline solution can be introduced into the circulation by means of colon washing, thus adding to the volume of the blood. I therefore lay great stress on this form of treatment, as one of the most valuable for this depleting condition. Thromboses can frequently be avoided by these injections.

When severe tenesmus exists, painting of the lower end of the rectum with a 2 per cent. solution of cocaine is frequently very advantageous. Prolapse of the rectum and anus can frequently be prevented by applying a strip of zinc oxide plaster from one buttock tightly to the other, so that the buttocks will support the bowel and mechanically prevent its protrusion.

SUBACUTE MILK INFECTION (SUMMER DIARRHŒA).

In this condition we have a gastro-intestinal disorder due to the toxins generated from the bacteria in milk. This usually occurs during the summer months when there is great humidity in the air. The symptoms are not so severe as those seen in the acute form of milk infection. It is usually met with among the poorer classes who buy a cheap milk which usually contains millions of bacteria. Victor Vaughn, of Ann Arbor, Mich., in a letter to me, stated that although it is possible to destroy all bacteria by repeated and continued sterilization, he found it impossible to destroy the toxins generated in milk even though the temperature was raised to 300° F.

Cause of Infant Mortality.—The weeds eaten by cows in their summer pastures are responsible for many cases of gastro-intestinal disease. Many of these weeds are poisonous and their juices pass into the milk. In support of this theory Hauser gives the statistics of mortality in a number of districts in his experience, classifying them by the soil and the weeds that grow by preference on certain soils. His tables indicate a lower death-rate on the granite and sandstone foundation. He contends that systematic eradication of weeds from pastures would banish certain gastro-intestinal affections in infants.

Bacteriology.—Bacteriological[1] investigation of summer diarrhœa commenced when Escherich, in 1886, published his work on the intestinal bacteria of infants and their relation to the physiology of digestion. Lesage, Hayem, and Baginsky contributed further researches, but the most important and exhaustive researches were made by Booker from 1886 to 1897. As the result of these he called attention to three principal forms of summer diarrhœa, based on a correspondence of their clinical, anatomical, and bacteriological features: (1) dyspeptic or non-inflammatory diarrhœa, in which the obligatory milk-fæces bacteria are found, chiefly the bacillus coli communis, the bacillus lactis aërogenes appearing in smaller numbers; (2) streptococcus gastro-enteritis, in which there is a general infection and ulceration of the intestine, with streptococci as the predominating forms, some bacilli being present as well; (3) bacillary gastro-enteritis characterized by a general toxic condition with less intestinal inflammation, and the presence in the stool of several varieties of bacilli, the proteus vulgaris being the most common.

Escherich studied the streptococcus cases more closely (1897-1899) and found the cocci numerous and in almost pure culture in the stools in acute, severe cases, while it was possible to isolate them from the urine and the blood during life and from the viscera after death. Clinically, the symptoms vary much in the mild and the severe cases; the stools may be watery and contain much pus and blood. Staphylococci have also been found in diarrhœal stools, but much less frequently than streptococci. Later Escherich described cases of dysentery due to a virulent colon bacillus. Valagussa found a bacillus belonging to the colon group and identical with that isolated by Celli and Fiocca from cases in Italy and Egypt. In 1898 Shiga, in Japan, described the bacillus dysenteriæ, an organism more nearly related to the typhoid than to the colon group, and Flexner found the same bacillus in one form of acute dysentery studied in Manila. Both Celli and Escherich tried to identify the bacillus they described with that of Shiga. The bacillus pyocyaneus has also been found in the stools of cases of epidemic infantile dysentery. It is evident, then, that no specific bacterium of gastro-enteritis has been found; there is one form in which the streptococcus is the predominating organism, and the bacillus dysenteriæ may possibly be proved to be the cause of epidemic dysentery both in children and in adults.

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[1] An editorial in Archives of Pediatrics, August, 1901.

Pathology.—Inflammatory lesions and ulcerations can be seen in the colon. It is rare to find the duodenum and jejunum involved. The microscopical findings of the stool show numerous bacteria, epithelial cells, detritus, and occasionally blood. Sometimes particles of food are also seen.

Symptoms.—Vomiting and diarrhœa as in the acute form are the main symptoms. If an infant has just recovered from an acute milk infection and is placed on milk feeding too soon, a relapse frequently occurs, which is a subacute infection. The stools are greenish and resemble those described in the acute form. There is a loss of appetite, a coated tongue, and the temperature ranges between 101° and 105° F.; at times the temperature may be normal or subnormal. The infant does not want to be disturbed, and is very irritable. The irritation and tenesmus accompanying this diarrhœa usually causes the rectum to prolapse, and from the constant discharges of the bowel the anus and buttocks are excoriated. An eczematous eruption frequently is seen between the thighs. Local infection of the skin and lymphatics, by the presence of the pyogenic bacteria, sometimes causes furuncles.

Diagnosis.—This is usually made when the history and symptoms are carefully noted. It is much milder than cholera infantum. The temperature is lower, the vomiting less, and the prostration not so marked.

Jonah W., seven months old, twin baby, bottle-fed, had been constipated since birth. There was a slight cough. The child had beaded ribs, cranio tabes, and baldness of the occiput. Since one month he had vomiting and diarrhœa. This had improved and disappeared entirely. The child was given milk, and ten days after the milk diet was commenced the symptoms of vomiting and diarrhœa again appeared, but in a milder form. Several furuncles were found on his scalp. Owing to the intolerance of milk, whey was given in the same quantity and frequency as the milk was formerly given. Rice water, barley water and thickened pea soup was allowed. Toast water was given for thirst. Cocoa, was also given without milk. The cocoa was made with rice water, in the following proportions:—

℞ Cocoa	1 drachm
Rice water	8 ounces
Sugar	1 drachm

Scald about five minutes.

A large dose of castor-oil followed by a 2-grain dose of tannopine every two hours was given. A high saline injection, 1 quart, temperature 115° F., was ordered to cleanse the rectum and colon; also for its stimulating effect.

The diagnosis of subacute milk infection, congenital syphilis, and furunculosis was made. The case recovered.

Prognosis and Complications.—This depends on the condition of the child. If there is a complication such as nephritis present then the prognosis is worse than if uncomplicated. If an infant can be *removed to the seashore from unsanitary surroundings* and proper food given, the prognosis is good.

Treatment.—Two points to be considered in this condition are: First, *stop all milk* for at least one week and give the stomach and bowels absolute rest. Second, *cleanse the stomach and bowels* of all offending *débris* which may have caused this trouble. Such cases should be put on a light nutritious diet.

The golden rule is to give the stomach and bowels absolute rest in both quality and quantity of food. The feeding interval should be longer and the amount of food reduced.

In substituting other forms of feeding, *pro tempore*, we invariably do so at the expense of body weight. It will always be noted that children deprived of milk will lose weight unless care is taken to substitute a proper nutritious food. The body will lose to such an extent that atrophy may frequently follow.

Formula for Weak Infants in Substitute Feeding.—When vomiting and diarrhœa persist give either:

Barley water	4 ounces
Rice water	4 ounces
Oatmeal water	4 ounces

Or:—

Whey	4 ounces

Feed every two or three hours. Add $^1/_2$ of yolk of egg to each feeding.

Sweeten with granulated sugar half-teaspoonful to each bottle. If fermentation exists—colic, greenish stools, and eructations—use saccharine, $^1/_2$ grain, instead of sugar for sweetening. When constipation is caused by continued use of barley or rice water, then sweeten with glycerine by adding $^1/_2$ teaspoonful of pure glycerine to each 4-ounce bottle of rice, oatmeal, or barley water.

Formula for Almond Milk Food.

Almond milk	4 ounces
Granulated sugar	1 teaspoonful

M. Feed above quantity every three hours.[1] Add $^1/_2$ yolk of raw egg.

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[1] See formula for all preparations in Dietary.

Medicinal Treatment.—A dose of castor-oil should be given at the beginning of the treatment, first to cleanse the gastro-intestinal tract, and secondly, for its constipating after-effect. Rhubarb and soda mixture in doses of one-half teaspoonful are valuable after the castor-oil has been given. The treatment described in the chapter on "Acute Milk Infection" should be carried out as well in this condition. The successful outcome of the case depends on proper rest, careful stimulation, and a thorough cleansing, aided by a decided change of air, to the seashore or to the mountains. Milk should not be given until all conditions appear normal. Essence of caroid in teaspoonful doses, every three hours, is serviceable. Powdered caroid combined with charcoal, in doses of 3 grains each, repeated several times a day, is very valuable.

Carbolic acid is extolled by some physicians with large experience in infantile diseases. S. Henry Dessau strongly advises a 1 per cent. solution of carbolic acid as an intestinal corrective when fermentation exists. He has not seen any toxic symptoms from its use. I can fully indorse his statement and usually advise watching the urine during the administration of carbolized water. A teaspoonful of a 1 per cent. solution, sweetened with saccharine, can be given three or more times a day. If no effect is noticed in twenty-four hours then $1\,{}^1/_2$ or 2 teaspoonfuls can be given at each dose. I have also used creosote water, 1 per cent. solution, in the same doses as carbolized water with excellent results.[1]

APPENDICITIS.

Appendicitis is an inflammatory condition in and about the vermiform appendix. Clinical experience has proven that inflammatory conditions in the right iliac fossa originate in the vermiform appendix.

Bacteriology.—The result of bacteriological investigations of appendicitis is far from satisfactory. The study of these cases simply emphasizes the fact that the presence of the streptococcus is usually attended with symptoms of the severest type. There is a great variability in the streptococci found here as well as in other inflammations. They may cause but slight disturbance, but are far more liable to result in general peritonitis or septicæmia. It must be borne in mind that in cases of perforation and abscess formation the absence from cultures of pyogenic cocci is of negative value. The pure culture of the bacillus coli communis has frequently been found alone, and also associated with the streptococcus pyogenes. Klecki[2] found that pathogenic bacteria of a most virulent type can penetrate the peritoneal cavity. This penetration is either during perforation or through the lymph spaces of the damaged intestinal walls.

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[1] See chapter on "Acute Milk Poisoning" for general treatment of Summer Diarrhœa.

[2] Annales de l'Institute Pasteur, vol. lix, p. 710.

Pathology.—For the purpose of pathological differentiation it is better to divide this affection into: First, catarrhal; second, ulcerative; third, gangrenous.

Catarrhal Appendicitis.—In this form the walls of the appendix are found thickened and hyperæmic. The lumen of the tube is filled with *débris* of inflammation. If this inflamed condition continues the canal may become obliterated. The catarrhal stage frequently ends in resolution.

Ulcerative Appendicitis.—In this condition the process involves the muscular coat because the mucous and submucous tissues have been destroyed. The ulcer frequently terminates in perforation.

Gangrenous Appendicitis.—In this condition, also known as intestinal appendicitis, rapid necrosis of all the coats of the intestine takes place. If a fæcal concretion exists and the ulcer perforates, an infection of the peritoneal cavity takes place from the virulent bacteria. Partial or entire necrosis sometimes takes place, resulting in sloughing of the appendix.

Suppuration frequently follows the serous exudation and a localized abscess is formed. The danger of such an abscess consists in the perforation taking place and the escape of the pus into the peritoneal cavity, setting up a diffuse peritonitis.

Causes.—The etiological factor in appendicitis is hard to define. We may have anatomical peculiarities of structure. In some instances continued constipation. In others the opposite condition; intestinal catarrh and diarrhœa have been thought to be the exciting causes of a given case of appendicitis. Irritation from toxic (fæcal) accumulations invite, rather than cause, this disease. Gouty families in which gall-stones or gravel in the kidney have been found, are predisposed to this affection. The name of *appendicular lithiasis* has been given to this form of appendicitis by Roux.

Injuries to this region, exposure to extreme cold and overindulgence in purgatives have been looked upon as causative factors. Whether foreign bodies, such as seeds or hair swallowed by mouth, will lodge in the appendix and cause this disease, is doubted by many.

Symptoms and Diagnosis.—In general practice we deal with two forms of appendicitis. The mild type commonly called catarrhal, and the severer form, the so-called perforative appendicitis.

Mild Form.—In this form the symptoms are so trivial that they frequently escape notice. Pain, localized, or as it frequently happens diffused over the whole abdomen, is complained of. It will, however, be noticed that the pain *radiates toward a focus which is in the right iliac fossa.* This tenderness corresponds to a point near the outer edge of the right rectus abdominus muscle. If a line is drawn from the umbilicus to the anterior superior spine of the right ileum, this point will be in the center and is designated as McBurney's point. There is usually a tympanitic percussion sound, and a circumscribed area of swelling can be felt. The tumor is usually of an oval shape and is about two inches or less in length.

In very young children the attack is ushered in with convulsions, whereas older children frequently have chills. Icterus, with deep pigmentation of the skin and of the conjunctival mucous membrane, may occur, but rarely. There is frequently such distinct retention of urine and pain in the bladder and external genitals, that we may be misled from the actual seat of the disease. In order to relieve the pain the child will usually lie on its back with the right leg drawn up to relax the abdominal muscles.

Fever.—The temperature rises very rapidly. In severe cases it is not unusual to find it has reached 105° F. on the first day. In milder forms of this disease the temperature will rise to 102° F., or less, on the first day. The temperature must not be looked upon as a guide. Not infrequently do we find *fatal cases in which a normal temperature* or even a subnormal temperature continued throughout the attack. Continued high fever means suppuration. A sudden drop to normal signifies either a resolution or more frequently a perforation.

The Pulse.—The pulse should be the guide in appendicular inflammatory conditions. While the same is usually accelerated, a sudden increase in the pulse-rate should be noted with suspicion. *The toxæmic process can therefore best be studied by noting the character and frequency of the pulse.*

Vomiting is an early symptom and one that occasions considerable discomfort. In mild forms of the disease vomiting gradually subsides. When peritonitis complicates, then vomiting usually recurs.

The Bowels.—It is difficult to say whether constipation or diarrhœa accompanies these attacks. I have seen several cases in which diarrhœa continued throughout the whole attack, so that my suspicion concerning typhoid continued until the localized area of inflammation formed. Frequently the symptoms of typhoid fever are so well marked that it is well to note the characteristic Widal reaction in differentiating appendicitis. On the other hand I have seen constipation continue until convalescence was established.

The appetite is usually poor. The tongue coated with a whitish fur. Accompanying the fever there is usually thirst. Pains *in the right thigh of* a neuralgic character are frequently complained of. If a child has fever and pains resembling colic, especially on the right side, suspect appendicitis.

Differential Diagnosis.—The diagnosis is usually not very difficult. A sudden pain localized in the right iliac fossa, associated with gastric or intestinal symptoms and fever, should render the diagnosis easy. I rely upon the examination of the blood as an important guide in determining the presence of pus in the system. See article and illustrations of blood, showing the reaction, in the chapter on "Blood."

We must not mistake appendicitis for an abscess in the right ovary. The same can be differentiated by a careful vaginal examination. In young girls where this is very difficult, an examination can be made with greater ease in the rectum. By means of bimanual palpation we can usually differentiate the same. Acute intestinal obstruction occurs frequently in young children. When the obstruction is due to an intussusception, bloody discharges from the bowels are generally present. In intussusception the tumor is found either in the median line or in the left side, whereas in appendicitis it occupies the right iliac fossa. When there is a strangulated gut due to a volvulus the pain is not localized. In this form of obstruction of the bowel there is usually stercoraceous vomiting.

Hip-joint disease and tuberculosis might possibly be mistaken for appendicitis. There are a great many cases in which a diagnosis will only be positive after the abdomen has been opened.

J. M., 17 years old, was referred to me with the following history: She was wet-nursed in infancy and suffered with constipation. When 4 years old had pneumonia, also scarlet fever and measles. When 8 years old had diphtheria, otitis, measles, chicken-pox and mumps.

For two years she has suffered with violent cramps in the stomach, pain in the back, and pain mostly in the right side in the region of the liver. These pains last from three to four days; they recur every three or four weeks, and simulate cramps in the stomach. Vomiting is frequently associated with these attacks. There is usually a temperature ranging between 101° and 103° F. Severe headache and constipation always accompany these attacks. The menstrual function is perfectly normal and independent of such attacks. From the nature of the attacks and the location of the pains an attending physician diagnosed gall-stones and biliary colic. There seemed to be some tenderness in the ileocæcal region. The case was referred by me to Dr. William T. Bull with a diagnosis of probable appendicitis. The operation was performed by Dr. Bull and a very long curved appendix was found which evidently accounted for the symptoms. The gall-bladder was explored and found in a normal condition.

The diagnosis of appendicitis was positive. The girl made a brilliant recovery and was observed by me for many months. All cramps and pains have subsided and she is entirely cured.

This case illustrates the striking similarity of symptoms pointing to biliary colic. The rarity of biliary colic in children must be considered before a positive diagnosis is made.

Course and Prognosis.—The prognosis depends on the time when treatment is commenced. *A mild case of appendicitis may resemble colic with a slight rise of temperature and pass off unnoticed.* If these attacks recur our suspicion should be aroused and the appendix removed. It is a good plan for the physician to call the surgeon in consultation when symptoms point to appendicitis. *Very young infants do not bear laparotomy* well, owing to the shock caused thereby, but if the surgeon operates *rapidly*, shock is greatly lessened. Cases of appendicitis frequently assume a chronic course. Attacks may recur at intervals of weeks or months. If the diagnosis is positive, it is much wiser to operate during the intervals of health rather than run the risk of a fatal complication such as peritonitis.

Treatment.—First and foremost, absolute rest in bed. The choice between hot-water bags and ice-bags depends on individual experience. In my own practice I have always favored hot fomentations. The application of several leeches in the early stage of the disease will sometimes prove beneficial. It is of importance to see that the bowels have an evacuation once or twice in each twenty-four hours. If vomiting persists cracked ice and champagne may be given. The value of opium is disputed by many. It certainly relieves pain, but prevents peristalsis. My choice has been codeine, $^1/_{10}$ grain, increased to $^1/_2$ grain, repeated every hour, depending on the age of the child, until the pain was relieved.

If the symptoms continue in spite of the above treatment, it is possible that medical treatment is insufficient. No time should be lost, but prompt surgical relief should be given.

When Shall We Operate?—A very important aid in diagnosis and in deciding the proper time to operate and one frequently overlooked, is the *blood examination* in this condition.

In appendicitis we have a *leucocytosis,* while in uncomplicated intussusception and typhoid fever, especially in the latter, leucocytosis is absent and leucopenia present. It is easy to see the value of this *differential* method.

Now as to its value in deciding the proper time to operate:—

Leucocytosis means pus—abscess.

Leucocytosis stationary, that abscess is walled off.

Leucocytosis increasing, spreading abscess.

Leucocytosis declining, favorable course.

From which we conclude that a steadily *increasing leucocytosis* is a bad sign—operate; while a steadily *decreasing leucocytosis* is a good sign—don't operate.

If a general peritonitis is present operative interference must not be delayed. It is in this class of cases that we find a general septic process and in which, in addition to the local manifestations, we have a general systemic infection.

PSEUDO-APPENDICITIS.

In atony of the bowel we frequently have impacted fæces. In such cases I have known constipation to cause colicky pains and sudden cramps, so that the children would cry out suddenly. Relief was quickly afforded by a high soapsuds enema which brought away the offending masses of hardened fæces. Fever is frequently an accompaniment of constipation. It is therefore an important matter to exclude all other factors before resorting to extreme measures and advising an appendectomy. The following two cases were reported by me in Pediatrics, Vol. XIII, No. 1, 1902:—

CASE I.—Maggie W., 10 years old, was perfectly healthy until the time of her present illness. She was suddenly attacked with pain, which was localized in the right hypochondriac region; the pain was very acute and was increased on pressure; the abdomen was distended and quite tympanitic on percussion; there was a marked dullness in the ileocæcal region; there was intense vomiting, the vomit containing particles of food along with mucus and bile and had a very offensive odor. The child vomited several times in one hour and seemed to vomit whenever the pain was most acute. The mother stated that the child had a regular movement of the bowels once in twenty-four hours, that she had had a movement that day and that her appetite had been quite good. She was a very strong and well nourished child with no evidence of organic disease; there was no hysterical element; the child complained of no other pain but that directed to this abdominal condition; there was a history of improper diet but no history of traumatism; the heart-sounds were normal; no murmurs were audible, the lungs were normal on percussion and auscultation; the liver did not seem to be enlarged; the spleen was palpable but not enlarged; the temperature was 104° F., taken in the rectum; pulse, 110; respiration, 20.

When first seen an ice-bag had been applied over the most tender spot in the abdomen. Codeine in $^1/_8$-grain doses had been administered and a liquid diet prescribed. The child was first seen by me about twenty hours after the commencement of her illness with the above-named conditions. As this case had been seen by another colleague I was requested to meet him in consultation. The diagnosis of perityphilitic abscess had been made and an operation advised. The diagnosis was not so positive owing to the history of overeating. The child partook of many kinds of cake and pastries while celebrating a birthday, and an overloaded stomach appeared most plausible. Hence an acute catarrhal gastritis was diagnosed. The pain and tenderness in the abdomen was ascribed to a colicky condition, resulting from fermentative processes in the stomach and extending into the intestine. The indication was to cleanse the stomach and bowels as rapidly as possible and thus remove the toxæmic condition which existed. Meanwhile an operation was not considered until after the above measures were used.

The urine was examined and showed a large excess of phosphates; no albumin, no sugar, no casts, no diazo-reaction; hence we excluded typhoid. There was a very strong indican reaction and this latter strengthened the diagnosis of fermentation due to intestinal putrefaction.

The Treatment.—I suggested the use of a very high enema with a long tube reaching into the colon; the enema consisting of 1 pint of glycerine diluted with 2 pints of warm water; the temperature of the same was 102° F. The enema was very effectual and brought away a large amount of gas. The temperature which, as above stated, was 104° F., fell to 102° F. within one hour and gradually returned to normal in twelve hours, although no other antipyretic measure was used. Small doses of citrate of magnesia were ordered, a tablespoonful hourly, to quench thirst and at the same time to have a slight laxative effect. A liquid diet was continued, and thirty-six hours after the above remedies were ordered the child was in a normal condition.

CASE II.—A female child, about 10 years old, was seen by me through the courtesy of Dr. L. Harris, with severe abdominal symptoms. The most prominent symptom was an intense pain localized in the right hypochondriac region, more especially in the ileocæcal region. There was a marked distention of the whole abdomen;

there was constipation and vomiting; the temperature ranged between 102° and 103° F.; the pulse, which was 110, rose to 120. The child complained of an intense headache; in the beginning she also had a chill. The history, as given to me by Dr. Harris, was that the child had fallen from a fence on which she was standing, in the yard, a distance of about three feet. He believed that she had injured herself. The doctor's diagnosis was peritonitis from traumatism. In this diagnosis I concurred. There was no distinct localized area of pain, but rather a diffused area of pain extending over the whole of the abdomen, which was intensified in the immediate locality of the injury. There were no chills; there were no rigors; the temperature rose gradually; there was no evidence of suppuration and none suspected. The child was placed on a carefully restricted liquid diet, consisting of broth, soup, strained gruel, milk, egg albumin in various forms and in addition thereto opium in the form of deodorized tincture was given to alleviate pain. Attention was directed to the bowel and an enema was given to flush the rectum and colon and relieve accumulated fæces.

Another colleague saw the child and diagnosed appendicitis, and suggested immediate operative treatment. I was again requested by the attending physician, Dr. Harris, to meet with this other colleague, and as a result, we decided not to have operative interference until we were satisfied that we were dealing with a purulent case. Palliative measures were used, such as ice, locally. In addition thereto the most absolute rest was enjoined, and the child made a brilliant recovery without an operation. We were satisfied that we were dealing with a traumatic peritonitis in which the local area of pain was due to the traumatism.

A careful review of the above two cases will show that when the diagnosis of appendicitis is made by a process of exclusion then greater care should be exercised before resorting to extreme measures.

In the first case the high temperature and the suddenness of the attack certainly showed marked symptoms pointing toward appendicitis. The high temperature was due to the toxæmic condition resulting from impacted fæces. The pain was an enteralgia due to a distended gut filled with gas. Such colicky conditions are so frequent in young infants that we could operate very frequently if the diagnosis of appendicitis were made every time an infant screams with pain. The cases above reported are very interesting as showing that cases will frequently have symptoms resembling perityphlitis or perityphlitic abscess, so that a differential diagnosis will be very hard to make. Not infrequently cases of appendicitis will be overlooked, and when such is the case, if they are of the catarrhal type, no harm will ensue therefrom. On the other hand, I must not be understood as disparaging the idea that no case of appendicitis requires an operation, but my object in calling attention to these two cases is to offer a plea that before a case of supposed appendicitis is subjected to an operation, that we should be sure that all other conditions, such as impacted fæces, as in my first case, and other allied conditions have been excluded in the diagnosis.

INTUSSUSCEPTION.

The most frequent form of obstruction of the bowel is that known as intussusception, or invagination of the bowel.

Intussusception involves three layers of the bowel, each layer consisting of all the intestinal coats: First, the outer layer is known as the intussuscipiens, the sheath or receiving layer; second, the internal is known as the entering layer which, together with the third, the middle or returning layer, constitutes the invaginated part known as the intussusceptum.

The clinical records show that about one-half of all cases occur at the junction of the small and large intestine.

When the ileum becomes invaginated in the colon, the condition is termed ileo-colic intussusception.

In less than one-third of all cases invagination takes place in the small intestine. This is known as ileal or jejunal intussusception. When this invagination takes place only in the large intestine it is called colic intussusception.

This usually commences at the ileo-cæcal valve and extends downward. It is felt as a tumor much larger than the swelling found in appendicitis.

Intussusception usually causes a recession of the abdomen from the side of the cæcum, while appendicitis, if it does anything, will at least prevent recession of the abdominal walls at this point.

Symptoms and Diagnosis. — Nausea and vomiting are among the earliest symptoms. Later in the disease the vomit becomes fæcal in character. The child has pain; assumes the dorsal position with the thighs drawn up on the abdomen. The pain appears in paroxysms accompanied with a discharge of blood and mucus. Rectal tenesmus also is present. The temperature ranges between 101° and 103° F. The pulse from 120 to 150 per minute.

The following case will illustrate intussusception as met with in general practice. The history was as follows:—

Infant B., five months old, had vomited for some time; was constipated, having had no stool for several days. The temperature was about normal; the abdomen was distended. Antiperistaltic movements of the stomach were noticed. The child was breast-fed. The breast was discontinued for a short time and barley water substituted to relieve the vomiting.

The family was alarmed and sent for Dr. A. E. Isaacs, of this city, through whose courtesy I saw the child several times in consultation.

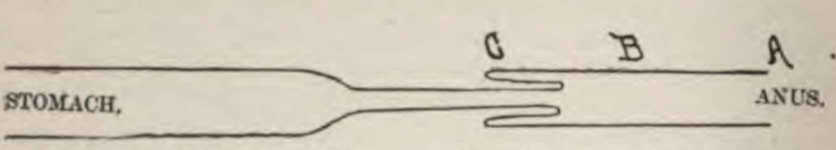

Fig. 88.—Mechanism of Intussusception (Treves). The sheath at *A* passes to *B*, then to *C*. The lower part of the intestine is drawn over the upper instead of the upper crowded into the lower. For a fuller description see Treves's "Intestinal Obstruction," London, 1884.

The vomiting continued in spite of the withdrawal of the breast-milk. Paroxysms of pain constantly recurring. Infant screaming. Repeated enemas did not result in emptying the bowels. Calomel had been given in both large and small doses with no satisfactory result. In addition thereto cathartics had been given, and this did not produce a cathartic effect. As the vomiting persisted, we believed that lavage would be of some benefit. The stomach was carefully washed with the aid of a Nelaton catheter. The cleansing solution was 1 quart of normal salt solution. The gastric contents were syphoned off until the return flow was clear. The stomach was then given rest for half a dozen hours and the breast-milk was again tried. The vomiting persisted, at the same time the distention in the abdomen continued. The diagnosis intussusception was made and an operation suggested. The family objected to the operation and palliative measures were used. The nurse was able to pass about fourteen inches of catheter into the gut until she reached the obstruction. We had hoped that probably a slough would relieve this strangulated gut. Later in the disease Dr. Isaacs was able to feel the mass of gut in the rectum about two and one-half inches from the anus, and to pass a catheter outside of the intussusception, as well as inside of it, some fourteen inches without reaching the limit of the invagination. The child was

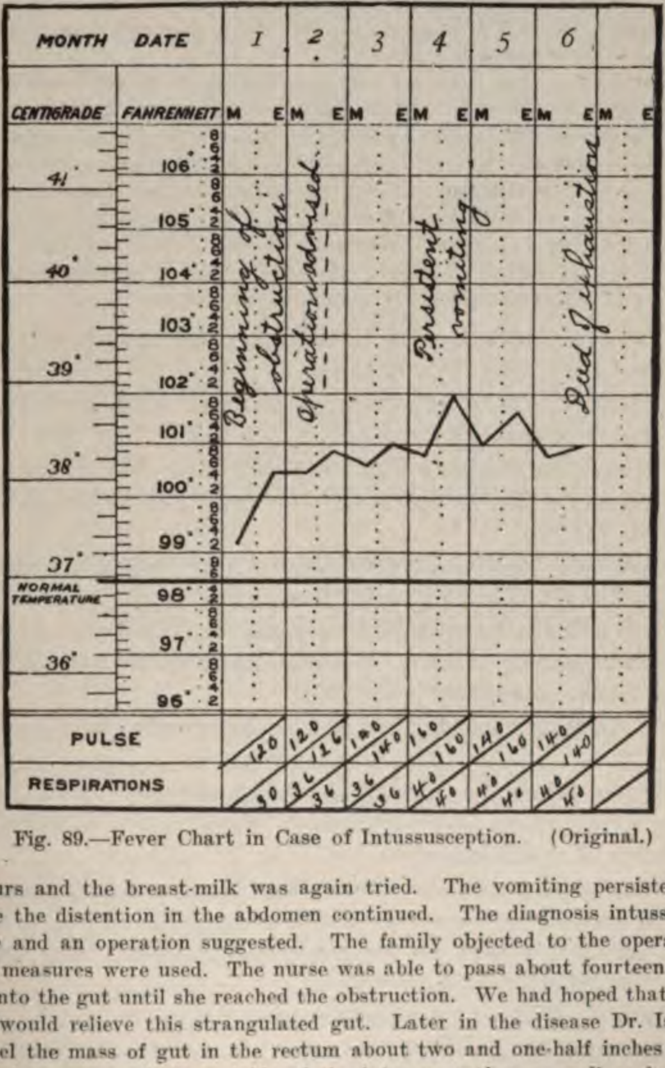

Fig. 89.—Fever Chart in Case of Intussusception. (Original.)

seen by me at three different times. The symptoms which were most marked in this case were:

1. Continued vomiting.

2. Fæcal impaction, the gut being so obstructed that no fæces passed in more than ten days, though flatus would occasionally pass.

3. During the first two or three days not only was clear blood passed per rectum, but large masses of *jelly-like mucus tinged with blood* were frequently expelled from the rectum until the end.

4. The distended belly, the abdomen abnormally distended, and very tympanitic on percussion.

5. The absence of all inflammatory symptoms such as rise of temperature until two days before the death of the patient, when the temperature rose to 101° F. and the pulse rose to 160. (See Fig. 89.)

6. Continued crying; the child with rare exceptions showed evidences of pain.

There was no positive etiological factor in this case, as there were two other healthy children in this family; the father and mother were in apparent good health. There was no evidence of traumatism nor anything that could be connected with the cause of this condition. The mother stated that for a period of two months before the appearance of this condition she had given a patent cathartic every day, as she thought, with advantage. Whether or no this drug had anything to do with this condition it is difficult to state. The presumption is, however, that the continued effect of giving cathartics was indirectly the cause.

In the above reported case an operation was refused and the child died. The chances were in its favor:—

1. Because it was a well-developed and well-nourished baby.
2. Because it was breast-fed.
3. Because the diagnosis was made very early in the disease.
4. Because the heart's action was very good, and no chronic or infectious disease existed.

In 1870 Pilz[1] reported 94 cases under 1 year—mortality, 84 per cent. From 1870 to 1891 135 cases, under 1 year, gave mortality of 59 per cent.

The reduction in percentage of mortality in recent years is evidently due to modern aseptic surgery. Whereas, formerly recovery depended on sloughing, to-day laparotomy is the rule.

Two interesting clinical points which I have made use of, are given by Caillé:—

1. Try to reduce the obstruction by non-operative means—injections of oil—the child in an inverted position following the injection; gentle manipulation of the abdomen.

2. In percussing the abdomen there will generally be found at the site of the obstruction *a very tympanitic area* adjoining a dull area. By carefully noting this point the surgeon has an important landmark for his guidance in performing the operation.

Prognosis.—Without operation the prognosis is exceedingly bad. The earlier the operation the better the result. In some cases Nature relieves the invagination and a slough will separate. This is, however, a rare condition.

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[1] Jahrbuch für Kinderheilkunde. Bd. iii, p. 6.

Treatment.—When the diagnosis is established no time should be lost. *Inflation of the bowel* with air or hydrogen gas through a long rubber tube has been recommended. When this is not successful the child may be inverted and gentle manipulation of the abdomen may be attempted.

Injections may be given with or without anæsthesia. The baby is turned on its belly, the hips are raised by gently supporting the abdomen on a soft pillow. The mouth and nose, being the lowest part of the body, must be protected. The baby is then anæsthetized with chloroform, and warm water is poured into the rectum with but little pressure, from a height not exceeding three feet. The injection is frequently intermitted, while the anus is closed with a cotton plug held by the finger. At the same time the abdomen, in the direction from below upward, is gently kneaded and its contents moved about.

Unless this proves successful no time should be lost and an abdominal operation should be performed.

Although surgical interference offers the best means of treatment, we should note the condition of the child at the time of operation, and consider the result of shock and hæmorrhage in estimating the therapeutic result. No cathartics should be given after the operation, but the bowels should be confined by administering a small dose of opium. Stimulation will be urgently demanded, hence whisky or iced champagne should be given *ab libitum*. It is well to remember that very young children do not offer good resistance to the shock of an abdominal section. Fully 50 per cent. of cases seen by me were fatal. The details of an operation for intussusception are those of aseptic surgery, for which my readers are referred to the special books on surgery. Dr. John F. Erdman, of New York City, has reported a series of successful operations in very young children.

UMBILICAL HERNIA.[1]

This condition is frequently seen in both male and female children. It is more often seen in the female.

Causes.—It is usually found in children with flabby muscles such as rachitic and atrophied cases. Severe abdominal strain during the paroxysms of whooping-cough or in continued constipation, frequently results in umbilical hernia. The tumor may be from one-half to one inch wide, and the same also in length.

Treatment.—*Preventative Treatment:* After the umbilical cord has separated, the usual flannel binder may be used to lend support to the abdomen for the first two or three months.

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[1] For Inguinal Hernia, see chapter on "Diseases of the Genito-Urinary Tract."

Mechanical Treatment.—A pad of absorbent cotton into which a thick piece of cork or a wooden button the size of a 25-cent-piece is wrapped, should be snugly pressed over the protruding part and secured by thick straps of zinc oxide plaster. This dressing should be renewed every four or five days. The treatment must be continued for several months.

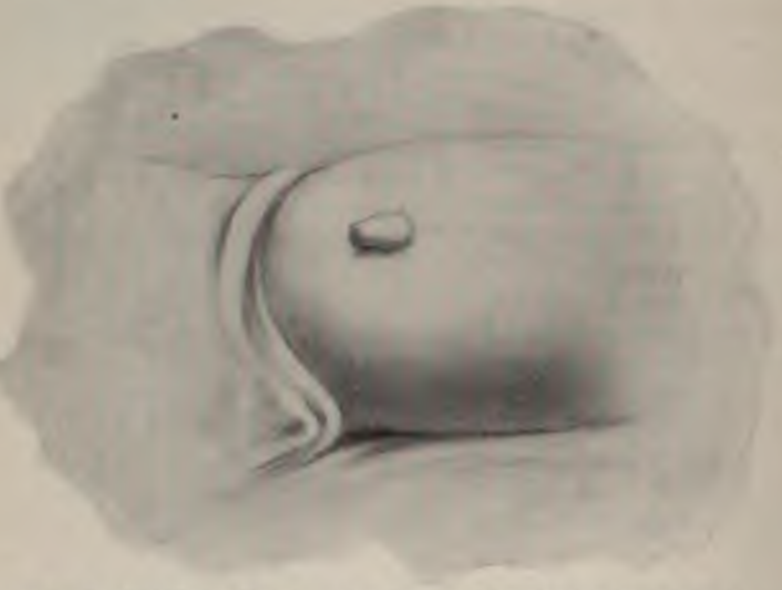


Fig. 90.—Umbilical Hernia. The result of violent paroxysms of whooping-cough. (Original.)

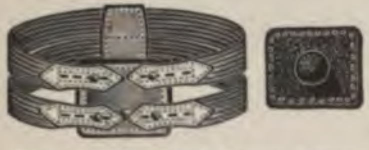


Fig. 91.—Umbilical Hernia Truss.

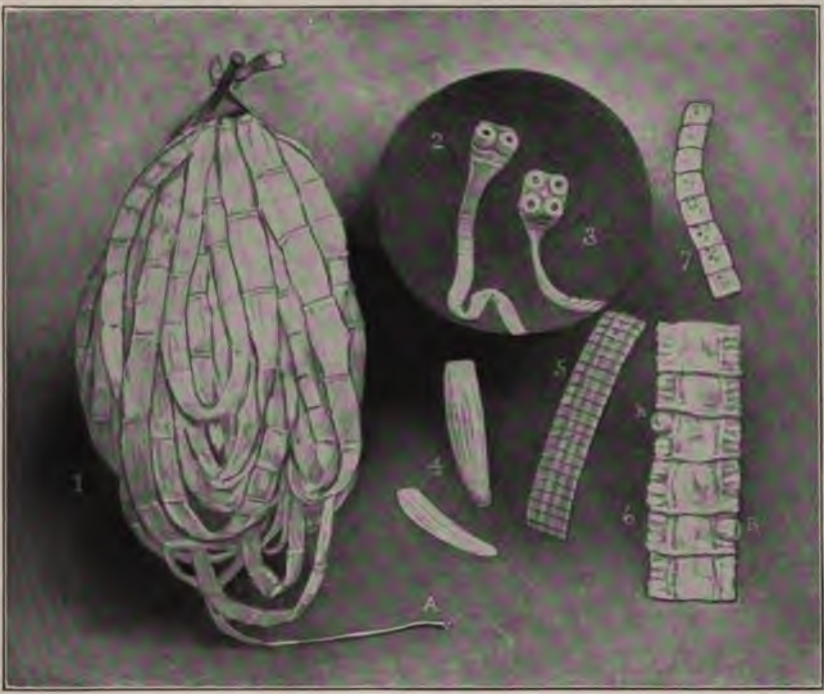
A truss, consisting of a rubber pad and a belt to pass around the body, should be applied, so that it cannot slip and has enough pressure to keep the hernia in place.

TAPEWORM (CESTODES).

The tapeworm enters the body by food containing the larvæ. Several varieties are met with. When the worm is fully developed it consists of rectangular segments or pieces. These segments are also called proglottides. The head and neck of the worm are called scolex.

The eggs (larvæ) of the tænia solium are found in pork; tænia mediocanellata, in beef; bothriocephalus latus, in fish; tænia cucumerina, in dogs and cats.

PLATE XIII



Cestodes (Tape-worms). *1*, Tænia saginata. *A*, Head of tænia saginata. *2*, Dorsal view of the head. *3*, Apex view of head, showing depression in center. *4*, Isolated, elongated segments. *5*, Bothriocephalus latus. *6*, Ripe segments of tænia saginata. *B*, showing location of sexual organs. *7*, Half-developed segments of tænia saginata. Illustrations drawn from specimens. (Original.)

Development of the Worm.—A worm develops in about three months. When the terminal segments are mature they separate and are discharged in the stool. As each segment contains both male and female organs, each one is capable of regenerating a whole worm. For this very reason the treatment of a tapeworm will never be successful until the head and every segment has been expelled. Tapeworms are estimated to live from ten to twenty, and possibly, thirty years.

The beef tapeworm is the *most frequent* found in children. It has four suckers, a square head, and no hooks. Raw meat may contain the cysticerci.

The pork tapeworm is the *rarest* found in children. The head has four suckers, surrounding which there is a circle of about twenty-six hooks. The length of the worm varies from ten to fifty feet. Nursing children are exempt from tapeworm.

Symptoms.—In children between 2 and 4 years of age subjective symptoms are difficult to interpret. In older children we will notice attacks simulating colic associated with fairly good movements of the bowels. There is restlessness at night and marked nervous irritability by day. The breath is foul and the child presents evidences of marked anæmia. In spite of an abnormally large appetite the body wastes and the child is believed to suffer with some latent form of tuberculosis.

Diagnosis.—The diagnosis is positive only when segments of the worm are found. The absence of cough or pulmonary symptoms will usually aid in excluding tuberculosis. At times several weeks will pass before a positive diagnosis can be made.

Prognosis.—The prognosis is usually good. It is simply necessary to use radical treatment to dislodge and sicken the worm and then expel it.

Treatment.—The tænicide should be given after fasting and followed in an hour by a cathartic to carry off the worm. The best tænicides are pomegranate or its alkaloid, pelletierine; filix mas; kousso; pumpkin-seed; turpentine, and cocoanut.

℞ Oleo resinæ aspidii	1 fluidrachm
Tinct. quillaiæ	1/2 fluidrachm
Tinct. aurantii dulcis	1 fluidrachm
Syr. aurantii, q. s. ad	7 fluid ounces

M. Sig.: A teaspoonful for a child 5 years old (C. W. Townsend).

℞ Tannate of pelletierine	1/2 grain

Sig.: For a child 3 to 5 years old (T. M. Rotch).

℞ Olei terebinthinæ	1 fluidrachm
Olei ricini	1/2 ounce

M. Sig.: Take it in one dose (Farqhuarson).

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Since entire expulsion of the tapeworm is effected with difficulty, preparatory treatment for about forty-eight hours should be employed before the vermifuge is administered. During this time the patient should take a mild purgative once or twice, and such food in moderate quantity should be allowed as leaves little residuum, as beef-tea, etc., with some stimulant if the patient feels exhausted. There are three articles of food which experience has shown to be especially useful in this preparatory treatment, perhaps from a sickening effect which they produce upon the worm, namely, salt herrings, onions, and garlic. This may, therefore, be taken as food in the twelve or eighteen hours preceding the employment of the vermifuge, which it is ordinarily most convenient to administer in the morning. (J. Lewis Smith.)

ASCARIS LUMBRICOIDES (ROUND WORM).

This worm is a reddish or yellowish round worm, usually from 5 to 10 inches long. The male worm is smaller than the female. This worm inhabits the small intestines. It is seldom found solitary, but usually 4 to 10 may be present. Some authors state that as many as 200 and 300 have been found at one time. The worm is usually found in children between the second and tenth years. It is never found in nurslings. These worms will wander from the small intestines into the stomach and irritate the gastric mucosa. They are frequently expelled by vomiting.

A child 4 years old was seen by me during my service at the Willard Parker Hospital in the fall of 1903. The child had pharyngeal and tonsillar diphtheria. It was a septic type of diphtheria. The child vomited *a round worm about 6 inches long* on the second day after admission. On the third day another worm about 5 inches long was also ejected by vomiting. There were no symptoms pointing to the presence of these round worms.

Some authors report worms wandering into the nose and also into the middle ear. A worm entering the larynx has produced fatal asphyxia. Another author reports jaundice due to worms entering the common bile duct. Worms have been known to produce hepatic abscesses. They have been found in the vermiform appendix. These worms appear most frequently in the stools. They have been found in umbilical abscesses.

Symptoms.—Very indefinite symptoms can be ascribed to these round worms. Irritation, such as restlessness at night, grinding of teeth, picking the nose, and scratching the anus. Abdominal symptoms, such as colic, diarrhœa, and tympanites are frequent. This clinical picture must not be presumed to be present in all cases. Not infrequently symptoms of meningitis will be mistaken for worms. Be sure to exclude all other conditions before expressing a positive opinion. Nervous symptoms such as hysteria, vertigo, and epileptiform convulsions have been noted while worms existed. As these conditions disappeared when the worms were expelled, it is but fair to presume that they were indirectly the cause of these nervous manifestations.

Diagnosis.—A positive diagnosis can only be made if the round worms are discharged from the body or if the ova is discovered in the stool. The microscopical examination, therefore, is very valuable and should always be made when in doubt. If the ova are still found in the stool after one or two worms have been expelled, then more worms should be suspected.

Prognosis.—The prognosis is always good, but the child must be kept under constant observation for at least several months.

Treatment.—To eliminate worms from the body, the tænicide should be given for several days and then followed by a brisk cathartic. The following formulæ have served me very well:—

℞ Magnesii sulphatis	4 drachms
Syrupi rubi idæi	2 fluid ounces

M. Sig.: A tablespoonful two or three times a week, to be preceded by santonin,[1] spigelia, or chenopodium. Once a day a high enema of soapy water should be given. The folds of the anus should be carefully cleansed with soap and water, and the following ointment applied:—

℞ Acidi boracic	1 drachm
Olei rosæ	3 drops
Vaseline	1 ounce

M. Sig.: Apply externally.

Other tænicides recommended by Townsend are:—

℞ Ext. spigeliæ	10 fluid ounces
Ext. sennæ	6 fluid ounces
Olei anisi	20 minims
Olei cari	20 minims

M. Sig.: Half teaspoonful for a child 2 years old, two or three times daily. Teaspoonful for a child from 4 to 10 years old.

Or:—

℞ Oil of chenopodium	2 drachms

Sig.: To be given on sugar three times daily, in doses of 5 drops, to a child of 3 years. Ten drops to a child of 10 years. A cathartic should be given every second or third day.

Oxyuris Vermicularis: (Pinworm: Threadworm).

The female worm is thin, yellowish white, and has a pointed tail. The male has a strongly curved tail. *The male worm is rarely found in the stool.* The female worm is present in greater number than the male.

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[1] The formula for santonin is given in the chapter on "Oxyuris Vermicularis."

The oxyuris is frequently passed in the mucus during a catarrhal discharge from the rectum. These worms frequently wander from the rectum into the vagina.

Symptoms.—Irritation and itching of the anus, causing restlessness and severe nervous manifestations, usually appear after the child is in a warm bed. The itching frequently gives rise to a desire for frequent urination. In severe cases it may lead to masturbation. The constant scratching to relieve the itching has produced vulvitis and vaginitis. Convulsions have been brought on by reflex irritation due to the presence of worms.

Treatment.—Threadworms are most effectually and easily removed by the use of enemata. For this purpose lime water, or an infusion of quassia, or solution of common salt (a teaspoonful of salt to four ounces of water), may be employed. In using these agents the bowels should first be cleansed by a copious injection of warm water. Jacobi recommends a decoction of garlic as an enema in these cases.

℞ Santonin	1 to 2 grains
Mild chloride of mercury	$^{1}/_{3}$ grain

M. Sig.: Every night for two or three nights, to a child 5 or 6 years old, and followed each morning by a purgative dose of castor-oil.

Or:—

℞ Santonin	1 grain
Compound liquorice powder	2 drachms

(Eustace Smith.)

CHAPTER V.

DISEASES OF THE RECTUM.

FISSURE OF THE ANUS.

AN ulcer having its long diameter parallel with the long axis of the bowel is occasionally met with. It occurs at the anal margin. It is seen in infants as well as in older children. It is caused by the passage of irritating hard fæcal masses. It is also occasionally seen after prolonged diarrhœa with continuous straining. Some authors state that traumatism from the nozzle of a syringe may cause a fissure. This I have never been able to verify. Streaks of blood of a bright red color will usually be seen in the stools when a fissure is present.

The prognosis is good.

Treatment.—This should be mainly hygienic, and consist in thorough cleansing of the parts. The application of solid nitrate of silver will usually effect a cure. The bowel should be relieved daily by the injection of sweet-oil or glycerine to soften the fæces. Some authors advise stretching the sphincter of the anus and keeping the parts at rest.

SIMPLE CATARRHAL PROCTITIS.

The rectum is rarely inflamed without additional portions of the bowel being involved. When the same exists, local causes must be looked for; for example, carelessness while irrigating the rectum. Mistakes, such as corroding or caustic drugs, can set up an inflammation. An instance of this kind occurred in my practice when a child received a strong injection of carbolic acid, causing inflammation. Infection extending from the vagina or urethra, such as gonorrhœa or diphtheria, can cause this condition. Syphilis has been known to affect the rectum. In simple catarrh the pathological lesions are the same as those found higher up in the gut.

The symptoms are pain when the bowels move. The stool contains mucus which may be distinctly separate. When folds of mucous membrane protrude they are very angry looking and show a deep red pigmentation. Children old enough will complain of intense burning and itching.

The treatment consists in using bland injections such as oatmeal water or starch water; when severe tenesmus exists, bicarbonate of soda, a teaspoonful to a pint of water, is beneficial.

CROUPOUS PROCTITIS.

This is the form usually associated with diphtheria of the genitals. Large and small pieces of mucous membrane are found mixed with the stool. Pathogenic bacteria, such as the streptococci and staphylococci, are found in the dejecta.

The treatment consists in using bland antiseptic irrigations, bichloride of mercury, 1 to 5000, or a normal saline solution, repeated several times a day. If diphtheria is present, antitoxin should be given (see chapter on "Antitoxin").

If syphilis is present the usual treatment for the same (see chapter on "Syphilis") is indicated.

ULCERATIVE PROCTITIS.

Tuberculous ulceration of the rectum has been reported by Steffen; also by Holt. Syphilitic ulcers are rare in children. There is usually bleeding and tenesmus. The blood is of a bright red color. The diagnosis is easily made by examination with a speculum and by no other means.

The treatment is very difficult. First, cleanse the rectum. Apply, locally, nitrate of silver with the aid of a speculum. The insufflation of iodoform, dermatol, or europhen is very practical.

HÆMORRHOIDS.

This condition is occasionally met with in children. It usually accompanies chronic constipation. The persistent constipation associated with cretinism occasionally causes this condition.

An instance of this kind was seen by me in a child about 2 1/2 years old, which was referred to me because it could neither walk nor talk. It had been operated for congenital adenoids by Dr. W. Freudenthal. The case had been under the treatment of Dr. A. Jacobi for one year. In this case chronic constipation was associated with hæmorrhoids. The stool was so hard and dry that blood was occasionally found after severe tenesmus. Thyroid treatment was directed against the cretinism, and malt extract ordered to overcome the constipation.

The usual treatment consists in removing the cause as much as possible as above described.

I have never met with a case under 12 years of age that required operation, although instances of this kind are occasionally described in surgical literature.

ISCHIO-RECTAL ABSCESS.

In excoriated conditions around the anus, following continued diarrhœa, an infection frequently results from scratching. Pyogenic bacteria undoubtedly enter the lymph channels.

A case of this kind was seen by me in the family of Dr. J. Grosner, of New York City. An infant nursing at the breast had dyspeptic symptoms, such as flatulence, and later, intestinal catarrh. An ischio-rectal abscess developed later on. It was benign and required a simple incision with careful attention to asepsis. This condition lasted in all about two weeks. The child made a splendid recovery.

At times we meet with very deep-seated inflammation which requires the skill of the surgeon. When a fistula exists proper surgical treatment is indicated.

PROLAPSUS ANI.

When children strain, especially during constipation, prolapse of the anus frequently follows. Not infrequently as much as one or two inches of the mucous membrane protrudes. (See Fig. 122.)

Causes.—There are three main causes: First, weakness of the levator ani muscles. In general atonic conditions—for example, in rickets—this condition frequently follows constipation, the constipation being a part of the rickety condition and indirectly causing a straining during defecation, thus ending in prolapse of the rectum. Deficient peristalsis, especially in young children, induces them to strain to expel hardened fæcal matter. On the other hand constant diarrhœa and irritation in the lower bowel may also result in prolapse. When an attack of summer complaint has lasted a long time, we usually find at the end of defecation that the rectum protrudes.

Second, when the ischio-rectal fat is deficient. In marasmic conditions, such as in athrepsia infantum or following the acute infectious diseases, when high fever and general wasting has taken place, the body fat suffers, and so the mechanical support of the rectum is lost.

Third, traumatic condition. This condition is frequently induced by coughing paroxysms, hence it not infrequently follows whooping-cough. Retention of urine, phimosis, and vesical calculi may cause this condition.

Diagnosis.—The size and the location of the tumor, and its appearance during the straining while at stool, renders the diagnosis easy. The ease with which the prolapse can be replaced is noteworthy in making a diagnosis. It is rare for this condition to be mistaken for intussusception (see chapter on "Intussusception"). A polypoid growth is usually found independent of the straining during defecation.

Treatment.—*Local:* Place the child in the knee-chest position and apply olive-oil to the prolapsed bowel, after which the gut can be replaced. When this mild manner of reduction is not successful, a whiff of chloroform should be used to quiet the child. This will also relax the protruding part. After replacing the gut the buttocks should be supported by a stout strap of adhesive plaster running from side to side. Cold water irrigations should be given. These will have the two-fold object of emptying the lower bowel as well as toning the muscle. Astringent injections of sulphate of zinc, 1 grain to the ounce, or tannic acid, 10 grains to the ounce, are recommended by some. I have failed to see any benefit therefrom. The local application of the tincture of the chloride of iron once every three days, has seemed to be of some benefit. The solid stick of nitrate of silver or cauterization by means of the Paquelin cautery, made red hot, is frequently recommended. Heroic measures, such as amputation of the parts, are rarely, if ever, necessary.

Constitutional Treatment.—We must not expect to cure a condition of this kind unless the body is strengthened. Restoratives, cereals, eggs, and milk must be prescribed. We can supply a deficiency of fat by ordering codliver-oil or lipanin, 1 teaspoonful three times a day. When constipation exists the addition of malt, as in a malted food, will aid this condition. Strychnine may be given in doses of $^1/_{100}$ of a grain, and increased gradually until $^1/_{60}$ of a grain is given, three times a day. Iron can also be given with great advantage. Massage of the abdomen and electricity must not be forgotten. A cold shower or spray over the spine and abdomen, repeated every day, is an excellent tonic.

CHAPTER VI.

DISORDERS RESULTING FROM IMPROPER NUTRITION (DISTURBED METABOLISM).

SCURVY (SCORBUTUS: BARLOW'S DISEASE).

This is a constitutional disease resulting from improper feeding.

Etiology.—It usually occurs before the end of the second year, and rarely occurs before the first six months of a child's life. As in adults, scurvy is found when fresh food has been withdrawn from the dietary. It is natural, therefore, to look for scorbutic cases among children who are:—

First, deprived of breast-milk.

Second, in those brought up exclusively on milk which is devitalized by *prolonged sterilization.*

Third, it is found in children brought up on condensed milk and on those *proprietary foods to which fresh milk has not been added.* There seems to be, therefore, a direct relationship between the absence of fresh milk, be it cows' milk or human milk, and the development of this disease. It is a great mistake to attach importance to the fact that an infant was fed on a proprietary food unless we know whether or no fresh milk was added. It is the absence of the live factor in fresh milk which directly causes scurvy.

Troup, of Christiana, quoted by Koettlitz,[1] is strongly of the opinion that scurvy is the result of a scorbutic element of the nature of a ptomaine present in the diet. Jackson and Vaughan Harley,[2] as a result of an experimental inquiry into scurvy, arrived at much the same conclusion. The question under discussion here is whether or not infantile scurvy is the result of the *absence of some essential element in the diet* or the *presence of some scorbutic factor.* It is certain that an infant fed for a long period upon peptonized milk, will develop scurvy, but if potato gruel and raw meat juice are added, yet no other alteration made in the diet and no medicine given, the scurvy will rapidly disappear and the child be well in a few weeks. Thus the addition of a fresh element to the scurvy diet has cured the condition. Moreover, many of the diets, for example, oatmeal and water, upon which the young children become scorbutic, seem to exclude the possibilities of the development of ptomaines. The experiments of Jackson and Harley do not carry conviction that true scurvy has been produced in animals, but rather that a condition of ptomaine poisoning has resulted. It is possible that unsound food may hasten the development of scurvy, but the evidence at present seems insufficient to invalidate the conclusion that infantile scurvy is due to the absence of an anti-scorbutic element rather than to the presence of some scorbutic poison.

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[1] Guy's Hosp. Gazette, March 30, 1901.

[2] Proceedings Royal Society, March, 1900.

Summary of Essential Conditions.—The six essential conditions to be observed in the diet of infants, are these:—

1. The food must contain the different elements in the proportions which obtain in human milk, viz.:—

Proteid	1.5 per cent.
Fat	3.5 per cent.
Carbohydrate	6.5 per cent.
Salts	.2 per cent.
Other constituents	.6 per cent.
Water	87.7 per cent.
	100.0

2. It must possess the anti-scorbutic element.

3. The total quantity in twenty-four hours must be such as to represent the nutritive value of 1 to 3 pints of human milk, according to age, viz.:—

Proteid	225 to 675 grains
Fat	231 to 693 grains
Carbohydrates	613 to 1839 grains

4. It must not be purely vegetable, but must contain a large proportion of animal matter.

5. It must be in a form suited to the physiological condition of the digestive function in infancy.

6. It must be fresh and sound, free from all taint of sourness or decomposition.

Pathology.—Hæmorrhages in and around the joints and in the muscles are found post-mortem. The most important point, however, is the presence of subperiostial hæmorrhage involving the long bones. Rotch states that the femora are the most commonly affected, and that there is a tendency to a separation of the epiphyses. Interstitial hæmorrhage involving the lungs, spleen, kidneys, and interstitial glands have been found. When the kidneys are involved we can usually find hæmaturia. Hæmorrhages are frequently present in the mucous surfaces; thus the gums show a deep purple color, besides being swollen and presenting the characteristic spongy appearance.

We are indebted to Barlow for his valuable studies regarding the pathology and symptomatology of this disease. The blood shows no specific changes which are pathognomonic to this disease.

Bacteriology.—No specific bacterium has as yet been found nor does the blood show any peculiarities bacteriologically.

Symptoms and Diagnosis.—The symptoms are marked irritability by day and restlessness at night, associated with insomnia. The mother or nurse will usually say that the child cannot be satisfied and cries whenever touched, most especially when the arms and legs are moved. It is very apparent that there is pain due to a swelling of the limbs, usually of the diaphyses just above the epiphyses. When not disturbed these children seem to lay quietly. Swelling of the limbs in the legs and forearm is usually present. While the skin over the swelling is tense there is no evidence of fluctuation. Tenderness on pressure is usually noted. Bluish-black spots, due to small subcutaneous hæmorrhages, are visible. When hæmorrhages affect the deeper parts around the eyes so that the eye itself will be pushed forward, a condition called proptosis will be noted. This condition of proptosis is found in advanced cases of scurvy.

Owing to pain in the limbs the child does not appear to move, giving rise to the impression that the child is paralyzed. When this condition is seen in scurvy it has been called pseudo-paralysis. The gums are very spongy and swollen, and have bluish maculæ over the surfaces. The child shows the evidences of marked anæmia and loss of weight. There is loss of appetite, and when food is taken the head perspires freely. The temperature rises in the evening to between 101° and 102° F. The pulse is small, feeble, and ranges between 120 and 140. The respirations are not affected. The clinical picture is one of marked malnutrition with symptoms simulating tuberculosis.

This disease is liable to occur in either sex; it is not influenced by climate or locality; it is found as well in the best as in the poorest hygienic surroundings. By far the greatest number of cases is found among the rich. It is evident that this disease is due to improper feeding more than to an improper hygiene. Some authors believe that this disease is caused by a specific micro-organism; this latter fact has not yet been definitely settled.

It is interesting to note the various views expressed by competent observers upon this subject; thus, while a large majority of clinicians hold that sterilized milk *per se* does cause scurvy, Rotch states that it does not, in his own experience, seem to do so. Starr maintains just the reverse and believes that sterilized milk is a causative factor. From my own experience I quite agree that sterilized milk—especially the prolonged sterilization, by which the albumins are changed, and by which this prolonged heating causes devitalization, which is so inimical to successful feeding—is a causative factor in this disease.

It is peculiar that scurvy will be cured by giving raw milk, fresh fruits, and acid fruits; still we find that a great many clinicians persist in prescribing sterilized milk until either rickets or scurvy is established. *It was for this reason that at a discussion on infant feeding at the Academy of Medicine, October 18, 1900, I was led to insist on the use of raw milk as the proper means of feeding children.*[1]

Raw milk possesses certain advantages over boiled milk; it is more readily assimilated and the proteids are not so difficult to digest. It is a well-known fact that boiled milk and sterilized milk have a tendency to produce constipation, whereas the opposite is true of raw milk.

Improper infant food has additional disadvantages when it is subjected to excessive heating. The large number of failures with milk modified at a laboratory are not so much due to the process involved in the modification as to the amount of heat that the food is subjected to prior to being imbibed.

Where milk is modified for infant feeding, using *raw milk only*, I have never seen constipation; the reverse, however, has always been true when milk was modified and then subjected to sterilization. The vital point has always impressed me as being, not so much to sterilize milk after it has been drawn from the cow, but to apply the principle of sterilization to the stable, the cow, the utensils, the milker's hands, and to everything coming in contact with the milk from the time it leaves the cow's udder until it is fed to the baby.

When oatmeal gruel or barley gruel is given with an insufficient quantity of cows' milk and then fed for a long time, we must not be surprised to find a case of scurvy. When proprietary foods are given without the addition of fresh milk, then scurvy will usually result. When cream mixtures are given which are deficient in fat and proteids, then scurvy may result. Thus we find that the true, underlying cause of scurvy is starvation due to deficiency of one or more nutritive elements in the food given.

The following case of scurvy will illustrate the condition:—

A child thirteen months old was brought to me with a history of being very restless and having lost considerable weight. The child showed a shriveled appearance of the skin; its normal elasticity was gone; the skin was dry; the thorax was pigeon-breasted; the arms and legs were thin; both arms and legs showed marked tenderness on the slightest motion; there was baldness at the occiput, and the anterior fontanel was not closed; the child had eight teeth, all of which were slightly carious; the gums around the teeth were deeply congested and showed bluish ridges; the gums were spongy and bled very easily; there was an intense fœtor to the breath; the child had been suffering from diarrhœa for the past two months, with occasional periods of constipation; there was no vomiting; the appetite had always been very poor. The previous history of the child was that, when born, it weighed about 5 pounds; it was very small at birth. The mother of the child died during confinement, and hence the baby was given into the care of a nursery. The diet consisted of 1 teaspoonful of condensed milk with 12 teaspoonfuls of water and a small pinch of sugar. This was fed every two hours for a period of over two months; later the child was put on barley water, to which some condensed milk was added. This was changed from time to time to a diet of oatmeal water and condensed milk.

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[1] Read also my chapter on "Scurvy," in the Third Edition of "Infant Feeding in Health and Disease." Published by F. A. Davis Company, 1904.

The child had always been frail, and had had a cough and also an attack of acute capillary bronchitis; during the summer the child had a severe attack of cholera infantum, and almost lost its life from vomiting and purging. For one month this child subsisted on a diet of oatmeal water, rice water, farina water, and albumin water, besides cold tea. Thus it is seen that the child received no milk for a period of over seven weeks. When the child was five months old it weighed 7 pounds, and at this time it hardly weighs 10 pounds. There is a marked rachitic kyphosis; the ribs are beaded; there is a pendulous belly; the child has an umbilical hernia; the temperature, taken in the rectum at 2 P.M. for a period of at least two weeks, was no higher than 100° to 101° F.; there is an intense thirst; the kidneys are very active; the urine has a very high color; no hæmaturia could be found.

The diagnosis of infantile scurvy was made and the child was put on the following treatment: Orange juice; lemonade; freshly-expressed steak juice; raw milk, diluted with barley water or rice water, equal parts (4 ounces of milk, 4 ounces of barley water), repeated every three or four hours, depending upon the appetite. Massage of the body was very gently performed with codliver-oil or vaseline, to lubricate and to nourish. A 1-drop dose of nux vomica was ordered before each feeding. This treatment was given continually for three or four weeks. Every fourth or fifth day a half-ounce of barley water or rice water was withdrawn, and instead an equal quantity of fresh milk was added; hence, after four weeks of treatment this child received 6 ounces of milk with 2 ounces of barley water or rice water every four hours.

The child was sent to the seashore, and after this treatment was continued for seven months all symptoms of scurvy had disappeared, though the symptoms of rickets were still very prominent. The prognosis now is very good, and the child will undoubtedly recover.

When children have walked, and suddenly stop walking and will not creep, then attention should be directed to the state of the gums and to the general physical condition. Such cases are usually suspicious, and show the beginning of the development of scurvy. Indeed, such symptoms will develop long before there is a general breaking-down. Emaciation and anorexia follow, which are associated in this condition.

Differential Diagnosis.—*From Rickets:* This condition is easily differentiated. In scurvy there is no rachitic rosary. There are no hæmorrhages involving the gums nor spongy swellings found in rickets. The pendulous belly is usually not seen in scurvy, neither is the rachitic square head frequently seen.

From Tuberculosis.—The absence of cough and other physical signs in the thorax common to tuberculosis besides the absence of the symptoms above mentioned common to scurvy, will differentiate this condition from tuberculosis.

Scurvy and Rickets.—Both diseases may be found at the same time in the child, and are evidently due to disturbances of metabolism founded upon dietetic errors in which the absence of the live factors in food have been neglected.

Prognosis and Course.—The course of the disease is usually chronic. I have seen cases of scurvy wasted to skin and bone, when hardly any muscle was left, and the fat almost gone and the elasticity of the skin lost. In spite of this shriveled condition, with proper feeding, in a few months' time, wonderful changes were made. I do not regard a case of scurvy as hopeless if some vitality remains. We must be exceedingly persistent and patient, and continue the treatment for weeks and months.

Treatment.—The most important part of the treatment of scurvy consists in eliminating the antiscorbutic elements by proper feeding.

Dietetic Treatment.—Antiscorbutic diet consists of fresh milk, fine potato gruel,[1] raw meat, raw yolk of egg, orange juice, and sugar.

Fresh milk is clearly not a potent antiscorbutic, and although sufficient to prevent scurvy when given in full quantity, will not always prevent it when taken in small amounts only. It fails accordingly to remove the scorbutic condition with quickness and certainty when given alone. It is necessary, therefore, to add to the food some more active agent, such as potatoes, carrots, or a vegetable juice, as orange juice, Malaga grapes, or a broth in which vegetables, such as carrots and potatoes, have been boiled and strained, with raw meat juice in addition.

In addition to the rigid enforcement of the above-mentioned foods, we must insist upon fresh air.

Hygienic Treatment.—Besides having fresh air, a child suffering with scurvy must be put directly into the sun. This sun bath should be administered for hours at a time. Proper ventilation of the sleeping apartment is very important. A scorbutic child requires a daily bath consisting of one pound of sea salt to a tub of water at a temperature of 95° F. The child should be bathed from three to five minutes and rubbed briskly while in the tub. After the bath the body should be dried with a coarse towel and rubbed until the skin has a pinkish color. This friction or massage is very invigorating, and if done in the evening it will promote sleep and soothe the child.

Medicinal Treatment.—Restoratives, such as pure codliver-oil, lipanine, or morrholine, given in doses of a teaspoonful two or three times a day, is indicated. Iron, such as syrup of the iodide, 10 to 30 drops, three times a day, or tincture ferri acetic ether, 10 to 20 drops, three times a day, may be given. Malt extract contains a live factor, and is therefore very valuable as an antiscorbutic restorative; it should be given in doses of a teaspoonful, two or three times a day, or until the bowels are loose, then the dose must be reduced.

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[1] Prepared by rubbing thoroughly steamed floury potato through a fine sieve, and beating this up well with milk until it is smooth and of the consistency of thin cream. A teaspoonful of this may be added to each bottle at first, and the amount gradually increased to a dessertspoonful, if it is found to agree. Well-boiled carrots may be used in the same way.

Maltine is one of our best preparations and has served me very well in scurvy. The successful outcome of the treatment of a case of scurvy depends on judicious feeding aided by the above-named associated conditions.

RACHITIS (RICKETS).

Rickets is a disorder of nutrition. It occurs chiefly between the ages of six months and 2 years. Congenital rickets is occasionally seen. It affects the bones primarily, and these are very readily distinguished during life. The disease also affects the ligaments, the mucous membrane, the muscles, and especially the nervous system.

Pathology.—The lesions are chiefly noticed in the bones, although the soft tissues show evidences of anæmia. The primary lesion is hyperæmia of the periosteum, the marrow, the cartilage, and the bone. The spleen and liver are usually enlarged. Frequently we note enlargement of the lymphatic glands.

Starck found the spleen enlarged in 50 per cent. of his autopsies in rachitic children, and in 68 per cent. of all his living cases. In the kidneys there are usually no pathological lesions. The cartilage cells of the epiphyses undergo increased proliferation from four to ten times more than they do in a normal growing bone. The matrix is softer; as a result the bone formed from this abnormal cartilage lacks firmness and rigidity.

The increased proliferation of cells makes the epiphysis larger, swollen in appearance, irregular in outline, and much softer in consistence. It has been experimentally proven that hyperæmia of bone causes defective decompositions of lime salts. Owing to this deficiency of lime salts the bones become very soft and flexible. While normally there is two-thirds mineral matter in the bones, in rickets this is reduced to one-third. Thus we can easily explain the various "rachitic deformities" which are especially noted in the femur, the tibia, the radius, the ulna, and the ribs. When ossification is retarded during rickets, as, for example, in the parieto-occipital region, the bone is frequently so thin that it yields to pressure, this is called craniotabes.

The fontanels are not closed until very late owing to this delayed ossification. The frontal and parietal protuberances are very much enlarged, due to exaggerated proliferation of the periosteum, so that the head acquires a broad forehead with characteristic frontal prominence. This condition is frequently taken for hydrocephalus. When ossification takes place the bones become large, heavy, and irregular in outline, corresponding to the clinical manifestations known as "bow-legs," "knock-knees," "pigeon-breast," "spinal curvature," and "square cranium."

Where the bone joins the cartilage, as, for example, on the ribs, enlargements occur which simulate beads; hence the term "beaded ribs," also called "rachitic rosary." The same enlargements can be felt at the wrists, ankles, and knees.

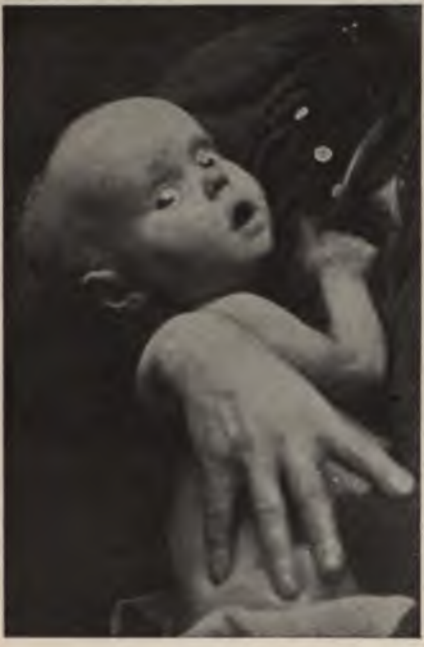
Fig. 92.

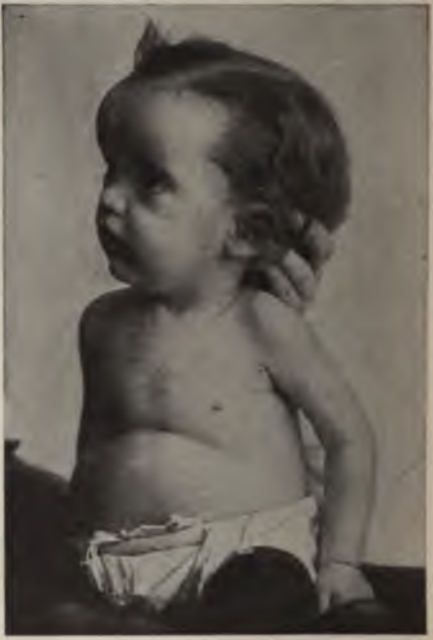
Fig 93.

Fig. 92.—Case of Hydrencephaloid (Spurious Hydrocephalus). Infant 8 months old. Bottle-fed. Suffering with cholera infantum. Severe nervous and toxic symptoms.

Fig. 93.—Same Child Two Years Later. Note the square head, the frontal protuberance. Also the Harrison's groove and the pendulous belly. The picture illustrates the cranial, thoracic and abdominal type of rickets. (Original.)

A *section* through the epiphyseal junction of a rachitic bone shows a very vascular, bluish-colored condition, which is softer than normal when cut. In the shaft next to the periosteum the bone is soft and thickened, but deeper it is hard. Sections through thickened masses on the flat bones show a spongy vascular substance which is soft enough to be indented easily.

Microscopical examination shows a marked increase in new cartilage cells and increased vascularity of the proliferating zone. The areas which should be calcified show large quantities of cartilaginous tissue instead. The under-layer of the periosteum is very vascular, and again there is a great excess of uncalcified cartilage. In the flat bones the bony trabeculæ are eroded, and their places taken by newly formed minute blood-vessels.

When the rachitic process ceases and recovery begins, this excessive proliferation stops. Calcification and ossification of these tissues take place; the enlargements due to the hyperplasia are absorbed, and the bone returns to a normal condition save for any deformities that may have resulted during the activity of the rachitic process.

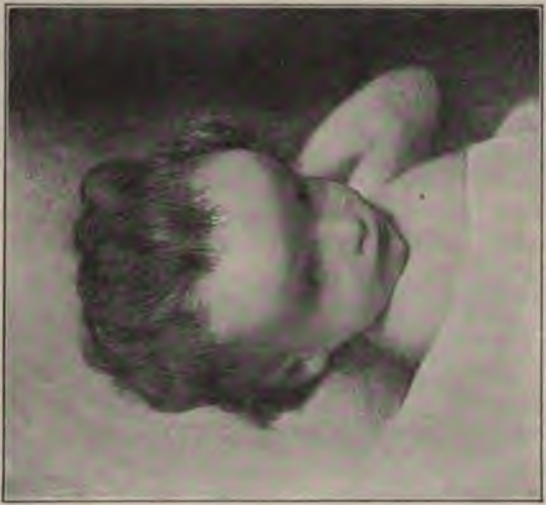

Fig. 94—A Case of Spurious Hydrocephalus, Illustrating Marked Frontal and Parietal Protuberances. There was a striking resemblance to a case of hydrocephalus. Bottle-fed. Rachitic. (Original.)

Chidren that have suffered prolonged diarrhœas or with severe diseases—like dysentery, typhoid, bronchitis, and pneumonia—are prone to the development of rickets. Children of syphilitic parents and those whose parents are tuberculous are more prone to the development of this disease. **Von Ritter**, quoted by Professor Baginsky, says that, in 27 cases out of 71 examined by him, rickets was not only found in the children, but as well in the mothers of these same cases. Thus it is that Kassowitz and Schwarz[1] have mentioned the existence of congenital rickets. These same authors found that 80 per cent. of children born in the Vienna Lying-in Hospital were rachitic. This statement is not so easily accepted, however, for neither

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[1] Wiener medicinische Jahrbucher, 1887, vol. viii.

Professor Baginsky nor Virchow accept the same. Experimentally, it has been found as long ago as 1842 by Chossat that when lime is deducted from the nourishment of young animals not only soft bones result, but they finally die. Heitzmann maintains that, if lactic acid is introduced into the food of young animals, the result will be, first, rickets, and, later on, osteomalacia will result therefrom. Clinical investigations have shown that cases of rickets occur more often during the winter months; thus it is apparent that improper ventilation is one of the most exciting causes of this disease.

When children are improperly fed so that the body is underfed, muscle and bone formation will be slow. The eruption of the teeth will be delayed, and this is one of the most prominent symptoms of rickets. The bones show the most characteristic result of improper nutrition, for they are very soft and spongy. They will yield to the weight of the body if used in walking, and thus it is that bow-legs with extensive curvatures form such a prominent feature in showing the result of using soft bones. The most typical symptoms can be studied on the head and spine. Thus, craniotabes can be explained by a deficient nutrition in which the cranial bones will be found so soft that they will yield to the pressure of the thumb. The cranial bones will frequently be found to be as soft and as thin as pasteboard. The spine is frequently deformed, and will show a typical rachitic kyphosis.

Causes.—The absence of human milk from the diet of an infant is one of the prime reasons for the development of rickets. We therefore find more than 90 per cent. of all cases of rickets among the bottle-fed babies. Other contributing factors are the absence of sunshine and the crowding of large families into small rooms having poor ventilation. Rickets will occasionally be seen in the breast-fed child. If the mother while nursing suffers with malnutrition, malaria, chronic cough, or with any organic lesion which devitalizes the body, then poor breast-milk deficient in its nutritive elements will cause the body to be underfed and finally result in rickets.

Breast-fed children will sometimes show rickets when they have been living in bad apartments, breathing foul air, and not being properly cared for. One of the most frequent causes of rickets is "prolonged" nursing. In the section on "Breast-feeding" I have already pointed out the necessity for making a proper chemical examination of the breast-milk if the infant "shows no increase in weight." We know that, toward the end of lactation, not only do the proteids diminish, but get to such a low percentage that, unless we combine hand-feeding by adding the raw yolk of egg, steak juice, and other proteids, like the cereals, to the breast-feeding, the child will be underfed. Underfeeding is certainly a contributing factor to the causation and the development of rickets.

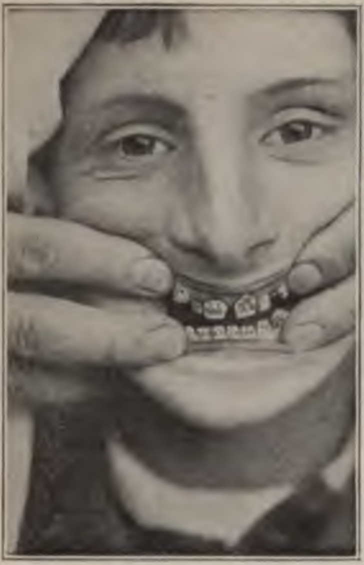
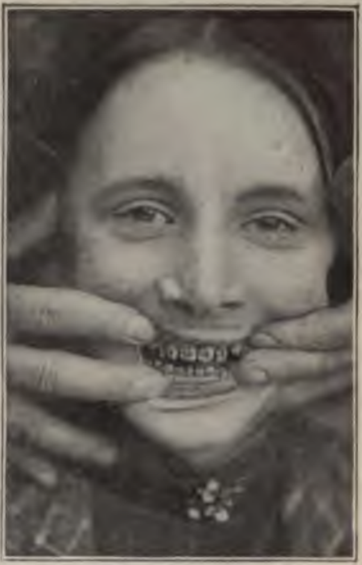


Fig. 95.



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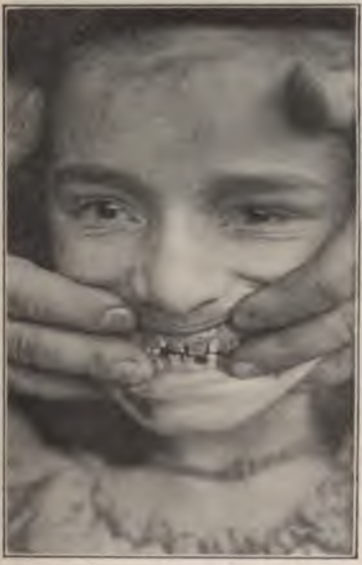

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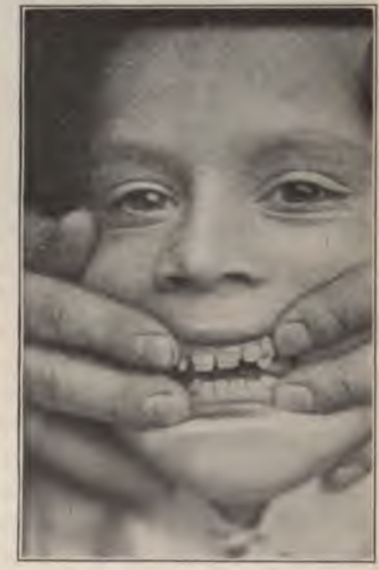

Fig. 98.

Illustrating Rachitic Erosions of the Permanent Teeth.[1]

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[1] I am indebted to Dr. Hugo Neumann, Privat-dozent in Berlin, for the above illustrations.

Symptoms.—One of the first symptoms noted is constipation. When there are evidences of gastric disturbances, unless properly treated, children will be underfed and rickets will result. Head sweating, especially at night, is an early symptom of rickets. Rolling of the head on the pillow, with occipital baldness, frequently precedes the development of rickets. Pallor of the skin and profound anæmia frequently precede or accompany the development of rickets. Rachitic changes affect the fontanel and the sutures, as well as the whole of the bones of the cranium. The rhombic form assumes an irregular outline. The sutures, especially the lambdoidal and frontal, are distended.

The fontanel remains open much longer than in normal infants, so that not infrequently the anterior fontanel can still be felt slightly open as late as the third or fourth year of life. Although the usual type of rachitic head is square, not infrequently it assumes an asymmetrical form.

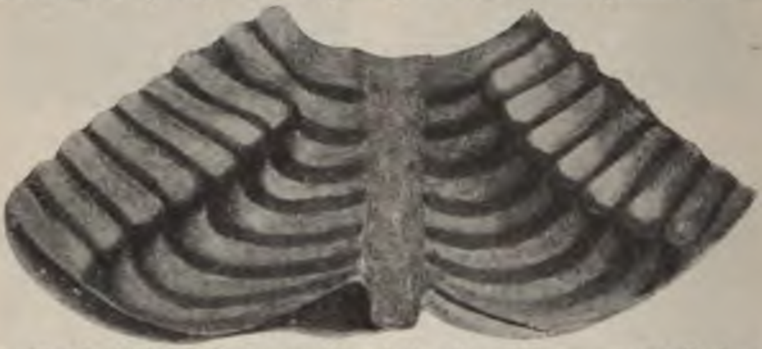

Fig. 99.—Rachitic Ribs. Incurvation of the ribs at the osseous-cartilaginous junction in rickets. One-half natural size. (Langerhans.)

We are indebted to Elsässer for a description of one of the most valuable symptoms in rickets, namely, "softening of the cranial bones," known as "craniotabes." Small areas of softened bone which will yield on the slightest pressure can be felt in the region of the lambdoidal suture.

Early symptoms of rickets also are tetanic seizures, muscular spasms, and laryngeal spasms. Dentition is delayed, the teeth appearing irregularly, and in older children they are carious. Not infrequently we find no evidence of teeth until the child is 16 or 18 months old. Rachitic symptoms appear later in the thorax than in the head, although they can be plainly made out during the first six months. Beaded ribs are especially prominent in advanced cases. There is a marked *depression of the thorax* in a line parallel with and on either side of the sternum. This line corresponds with the course of the beads. The so-called pigeon-breast or funnel-breast (pectus carinatum) is frequently observed in rickets.

The veins of the scalp are usually enlarged. Spinal rickets is especially characteristic. The posterior curve of the spine is commonly known as rachitic kyphosis. It extends from the middle-dorsal to the sacral region.

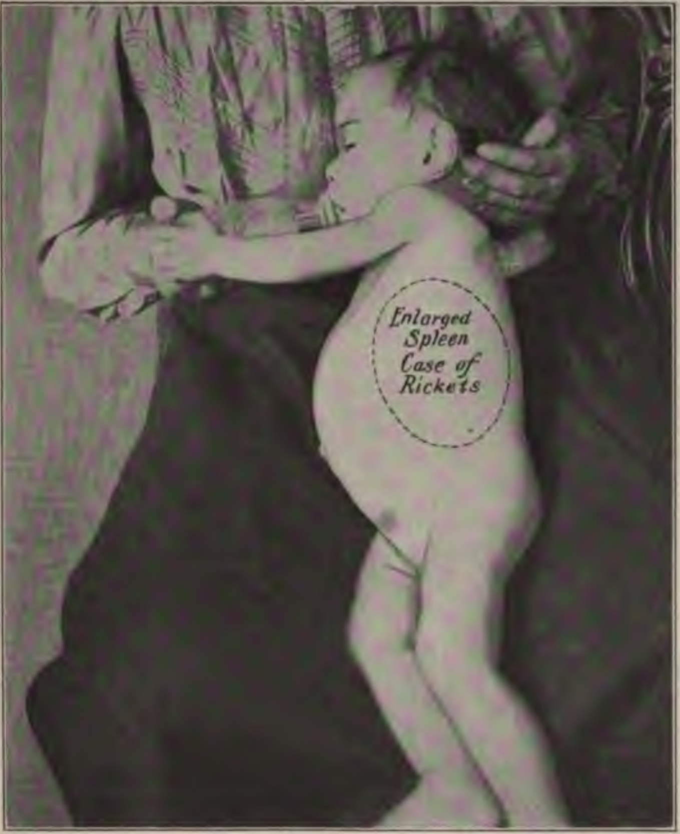

Fig. 100.—Case of Rickets Showing Enlarged Spleen, also Pendulous Belly. (Original.)

This kyphosis has been found in more than one-half of my cases. The curve can be lessened or it will disappear when the child is placed on its back and extension is made on the extremities. The more important rachitic deformities are:—

1. Rachitic kyphosis.
2. Rachitic scoliosis.
3. Chicken (or pigeon) chest.
4. The rachitic pelvis.
5. Cubitus valgus or varus.
6. Distortion of the lower extremities:—
    - *(a)* Genu varum.
    - *(b)* Genu valgum.
    - *(c)* Anterior curvature of the tibiæ.
    - *(d)* General distortions of the lower limbs.

Diastasis of the Recti Muscles in Rickets.—When the muscles lose their tone, we frequently have the bony changes soon afterward. Diastasis of the recti muscles of one-half or one inch can sometimes be made out. To properly examine a child for this condition it should be laid on its back with the head and shoulders elevated, thus the recti muscles will relax and a protrusion of the abdominal contents in the median line can be noted.

The clavicle is affected only in severe cases. Not infrequently there may be a green-stick fracture. I have frequently noted the exaggeration of the anterior curve at the inner third of the bone which is described by Holt. There are various pelvic deformities such as the narrowing of the subpubic arch. There is also a contraction of the antero-posterior diameter of the pelvic bones. For further details I will refer the reader to Garrigues' "System of Obstetrics." In girls the neglect of rickets in infancy may mean serious trouble in womanhood if pregnancy occur.

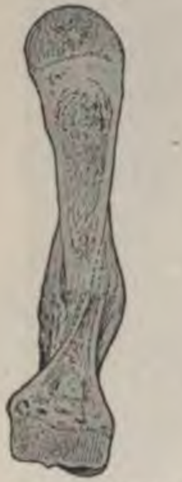
Fig. 101.—Five-weeks-old Fracture of the Humerus, in a Rachitic Child 1½ years old. (Langerhans.)

Extremities.—It is not difficult to note deformities in the humerus. The epiphyses, as in all long bones, are thickened and enlarged. The thickening of the epiphyses in the radius and ulna is readily made out. The shafts of these bones describe a convexity upon their extensor surface. Green-stick fractures are very common in these bones. The ends of the metacarpal or of the phalanges are sometimes enlarged.

The Lower Extremities.—The outward bend of the tibial and in marked cases of the femoral produce the condition known as bow-legs (genu varum). (Fig. 103.) In these cases when the feet are put together the knees are far apart. The opposite condition known as knock-knee (genu valgum) may exist The inner condyles of the femur are hypertrophied, so that when the knees are put together the feet are far apart. Knock-knees are more common in females. The ligaments around the joints are relaxed and weakened, so that from an anatomical standpoint they assist in producing this deformity. The muscles show marked evidences of this disease. They are flabby, soft, and small with poor development. This accounts for the lateness in walking. The muscular power is very feeble, and not infrequently paralysis will be suspected when really we are dealing with aggravated rachitic muscles.

Malnutrition is plainly made out on studying these emaciated, anæmic children whose bones are markedly rachitic. On the other hand we frequently find very fat children with extreme pallor showing marked rickets.

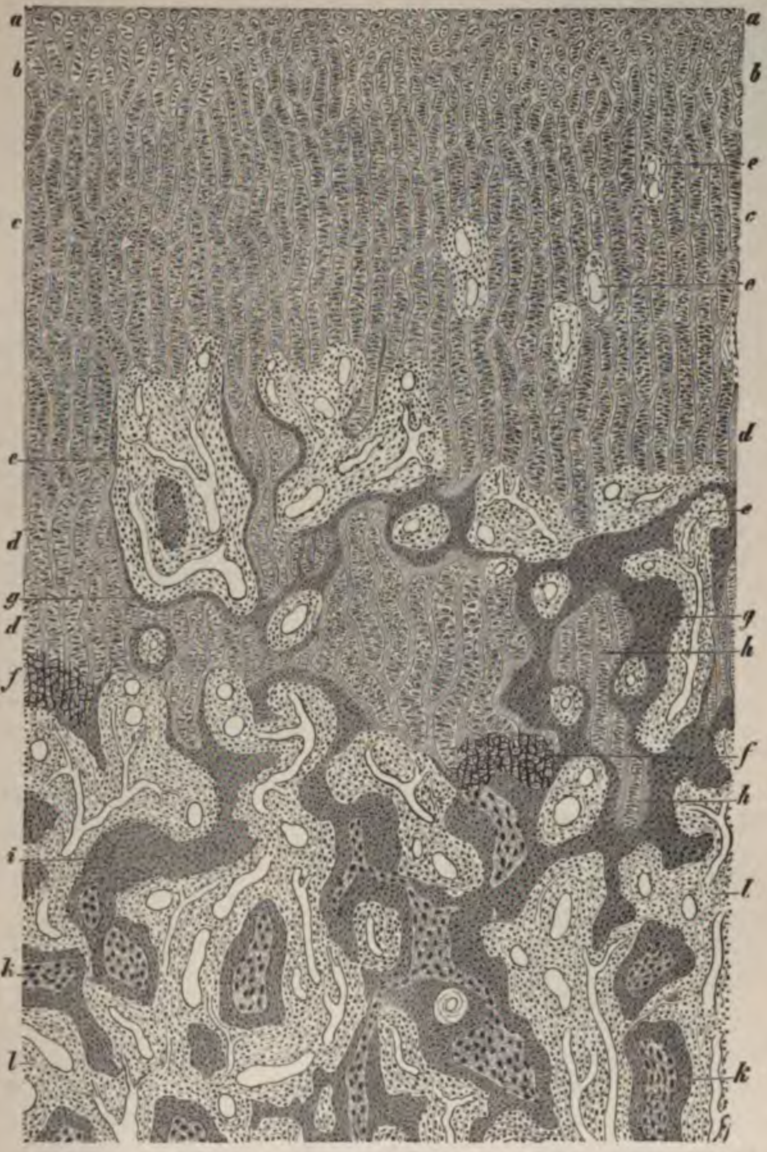

Fig. 102.—Rickets. Longitudinal section through the ossification junction of the upper diaphyseal end of the femur of a one-year-old child suffering from rachitis of moderate degree. *a*, Unaltered hyaline cartilage. *b*, Cartilage in the first stage of proliferation. *c*, Zone of proliferated cartilage cell columns. *d*, Columns of proliferated hypertrophic cells. *e*, vessels located in the cartilage, with fibrous marrow tissue. *f*, Decalcified cartilage tissue. *g*, Osteoid tissue. *h*, Remains of cartilage tissue in osteoid tissue. *i*, Trabeculæ of decalcified osteoid tissue. *k*, Trabeculæ of osteoid and fully formed calcified bone tissue. *l*, Fibro-cellular marrow tissue. (Ziegler.)

Therefore, a *fat infant is not necessarily a healthy infant.* The abdomen is enlarged and usually tympanitic on percussion. It is commonly known as the "pendulous belly." This latter symptom I met with in fully 90 per cent. of my cases in a large children's service extending over many thousand cases. I have rarely failed to note the distended belly in rickets. The loss of tone in the abdominal muscles, and especially in the muscular walls of the stomach and intestines, is one of the prime reasons for constipation. Occasionally the reverse may be true and diarrhœa may be noted. There is frequently marked distention of the stomach and colon. The stools are hard and dry, causing a chronic catarrh of the colon. We frequently find at the end of the stool a large amount of glairy mucus.

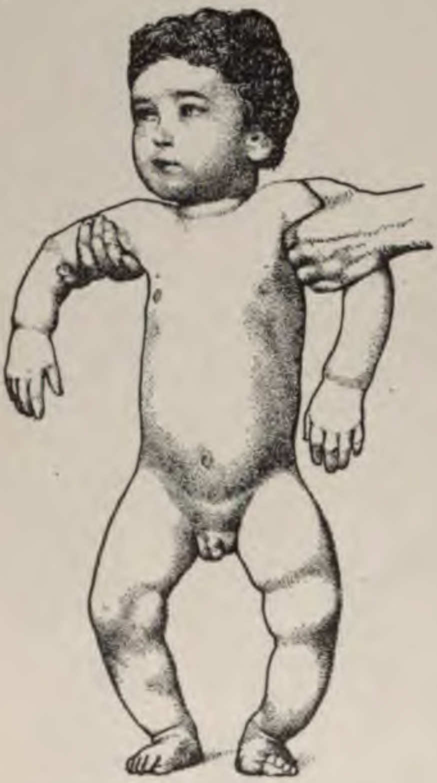

Fig. 103.—A Severe Type of Rickets With Enlargement of Both Condyles of the Femur. There is also enlargement of the upper epiphyses of the tibia and fibula. The illustration also shows enlargement of the epiphyses of the ankles. An antero posterior curvature (giving the bow-leg appearance) is plainly seen. Note also the enlarged epiphyses of the radius and ulna. Drawn from a photograph. (Original.)

The pulse and temperature are normal. Occasionally a bruit can be heard over the anterior fontanel. It has no special significance. There is nothing characteristic in the urine in rickets. The blood has been studied by Morse, who concludes that anæmia is present in most cases. Its intensity varies with the intensity of the rachitic process. Leucocytosis may or may not be present. An enlarged spleen is met with in these cases.

Convulsions and spasms of various descriptions occur frequently in rickets. There seems to be a predisposition to general tetany, and to laryngeal spasm (laryngismus stridulus). The general weakness of the body is also seen in the marked tendency to irritation in the nerve centers. *Most diseases in rachitic children are ushered in with convulsions,* thus showing the extreme sensitiveness and susceptibility of the nerve centers. An overloaded stomach in a rachitic child under 1 year of age, suffering with high fever, is usually attended with hyperpyrexia and convulsions.

Diagnosis.—This is usually very easy. Head sweating, constipation, restlessness at night, delayed dentition without palpable osseous manifestations usually mean rickets. The most prominent symptoms are beaded ribs, enlargement of the epiphyses of the wrists and ankles, kyphosis of the spine, and bow-legs.

Differential Diagnosis.—The rachitic head is sometimes mistaken for hydrocephalus. The electrical reaction will decide whether or no we are dealing with a poliomyelitis, or if the case is a pseudo-paralysis with rickets. We must differentiate the bony enlargements of syphilis from rickets by remembering that the *bony changes in syphilis affect the shaft of the bone* rather than the extremities as previously described. An important point to remember is that in syphilis there may be necrosis. This is never seen in rickets. The differential diagnosis will best be made by obtaining a complete clinical history and eliminating all doubtful symptoms. Scurvy is easily differentiated from rickets by the spongy condition of the gums, by the tendency to hæmorrhage, and usually also by the presence of ecchymotic spots. The diagnosis of rachitic kyphosis from spinal tuberculosis (Pott's disease) is easily made, although I have seen one case in which there existed a rachitic kyphosis in a tuberculous child.

Prognosis and Course.—Rickets, *per se,* is rarely fatal. The active symptoms exist about one or two years; in rare instances for many years. Permanent damage of the system may remain throughout life. Spinal curvatures and thoracic deformities will remain for many years.

Rachitic children when attacked by infectious diseases suffer far more and the prognosis is graver than it would be otherwise. The abnormal condition of the thorax in rachitic children must always be taken into consideration in a child suffering with pneumonia, pleurisy, or other pulmonary conditions, in estimating the outcome of the disease.

Treatment.—*Prophylactic Treatment:* The preventative treatment of rickets consists in giving the infant healthy surroundings, plenty of fresh air, and by all means human milk of the required quality and quantity.

Hygienic Treatment.—When rachitic conditions are established the first thing to do is to insist upon removing such children to healthful surroundings. When children are housed in poorly ventilated homes, dark rooms, without sunshine, it is useless to give medicine until the unsanitary surroundings are improved. Successful treatment in such cases demands *plenty of sunshine,* open windows, night and day, a tub bath with a handful of sea salt added every day. After the bath good brisk rubbing to stimulate the circulation is very necessary. A change of air from the city to the country is desirable. When we are prescribing for the poor they should be instructed to remain in the park as much as possible. The establishment of *small roof gardens* on the tops of the highest dwelling or tenement houses makes a cheerful place for the rachitic children to play.

Dietetic Treatment.—Next to hygienic methods the care of the diet is important. If a nursing infant shows rachitic symptoms the chemical examination of the breast milk, as outlined (see chapter on "Chemical Analysis of Breast Milk"), should be determined. If we find low proteids the nursing mother or wet-nurse should be given more meat, eggs, and cereals. If, however, conditions exist which prevent proper nursing, the child should be weaned. A properly modified cows' milk adapted for the age and development (see chapter on "Infant Feeding") should be substituted. When rickets exist, proteids are demanded. I insist on feeding such children with cereals, such as barley, rice, cream of wheat, sago, farina, etc., and giving them plenty of fresh vegetables, such as spinach, asparagus, peas, and beans. Eggs, white meats, and fish may be given if children are old enough. Fresh fruits must not be forgotten. Butter and cream are valuable adjuncts to the dietary.

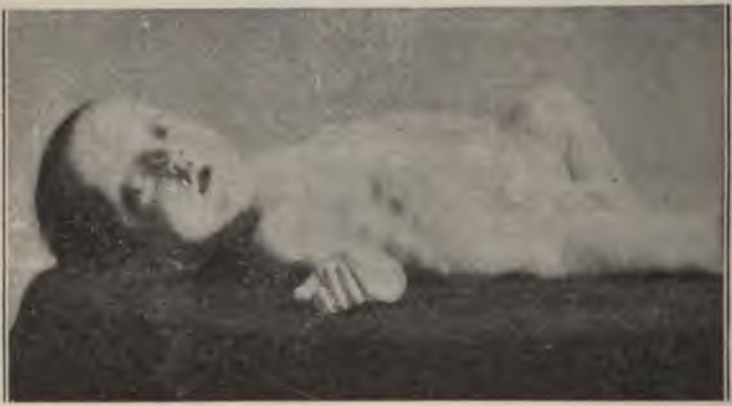

Fig. 104.—Rickets, Showing Beaded Ribs and an Enlarged Pendulous Belly. Mouth-breather due to adenoids. Breast-fed infant. Always lived in tenement house district. Mother very anæmic. (Original.)

Medicinal Treatment.—In addition to the importance of proper feeding we must seek to establish proper metabolism. All the emunctories must be carefully watched. Drug treatment should be directed to supplying the deficient amount of lime in the bones. The glycero-phosphate of lime which has been used by me for several years, in doses of 1 to 5 grains, three times a day, is very useful. Codliver-oil or morrholine, to which $^1/_{200}$ grain of phosphorus is added, has served me very well in some instances. This phosphorized codliver-oil must be freshly prepared, as it deteriorates on standing. Quite a discussion as to the value of phosphorus has arisen abroad during the last few years. Monti, of Vienna, and Baginsky, of Berlin, and Zweifel, of Leipzig, deny the medicinal virtue of phosphorus in rickets. The claims of Kassowitz, of Vienna, the originator of this treatment, have not proven successful in my hands. Hundreds of children in the crowded sections of the city have been put on the phosphor treatment. When codliver-oil *was added* to the phosphor, good results were noted, not otherwise; so that I believe it is the codliver-oil rather than the phosphor that possesses medicinal virtues. Fellows' syrup of hypophites, arsenic, iron, and strychnine have served me very well, especially when atony of the stomach or dyspeptic conditions existed. The careful regulation of the bowels and good action on the part of the kidneys and skin will greatly aid in modifying rickets when established.

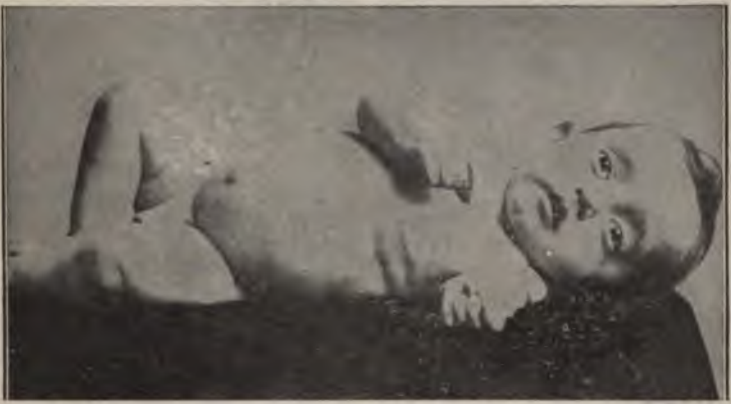

Fig. 105.—Rickets. Note Beaded Ribs on Left Side of Thorax. (Original.)

Treatment of Deformities.—*Kyphosis:* In rachitic kyphosis a Bradford frame or a similar appliance is indicated. A spinal brace will sometimes do good. Massage with good friction will develop a weakened spine in some cases, and plaster of Paris jackets may be serviceable. Manual correction of the deformity will aid in the treatment.

History of Rickets in Infancy.—A very anæmic, poorly developed girl. Brought up in a tenement house in the thickly crowded portion of New York City. Was breast-fed during infancy, fifteen months. Had summer complaint. Dentition began at eight months, walking at sixteen months. Very bright mentally. Is very restless at night, nervous choreic twitching during the day. No mammary development, no evidence of menstruation.

Father and mother of this child are apparently well, though dyspeptic. No evidence of syphilis or tubercular disease. This child has had tonsillar infections several times each year; had diphtheria, measles, and scarlet fever. Has diarrhœa whenever nervous or frightened.

Since instituting gymnastic exercises, the muscles of the back have been greatly strengthened, although the spinal deformity has not been lessened or improved.

The main treatment consisted in fresh air, out-of-door exercise, diet of milk, cream, butter, fruits, cereals, and meats. Stop school and all studies.

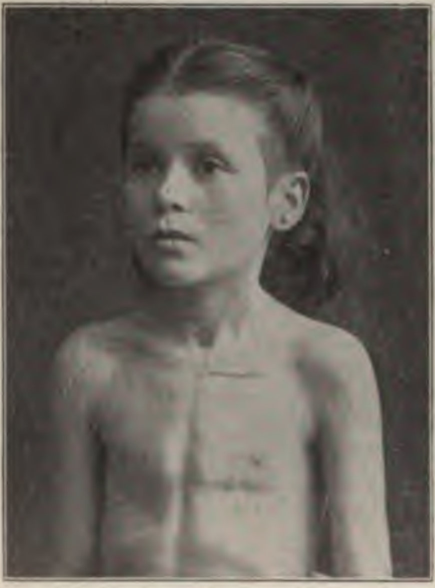

Fig. 106.

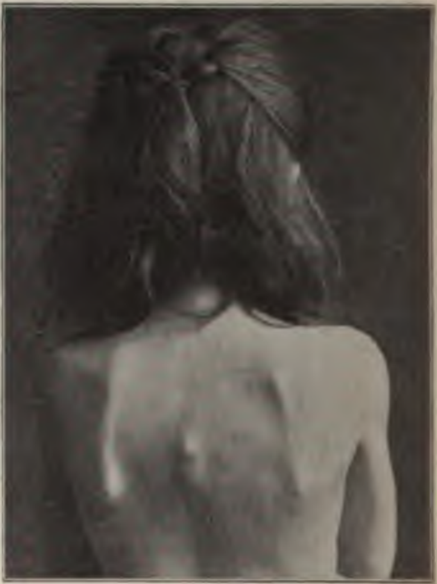

Fig. 107.

Fig. 106.—Rachitic Kyphosis (Spine). Permanent deformity. Rachitic thorax in school girl, 12 years old, showing Harrison's groove, and funnel-shaped depression of sternum.

Fig. 107.—Back View Same Child, Showing Rachitic Kyphosis. This deformity is the permanent result of rickets in infancy. It is to be differentiated from Pott's disease. Note also the curvature of the spine. (Original.)

Medication, codliver-oil, malt, glycerophosphate of lime and soda, raw eggs, wine in moderation. Cool sponging with sea salt. Friction of body after gymnastic movements.

Scoliosis (*Lateral Curvature*) *and Lordosis* (*Forward Curvature of the spine*)—The management of these conditions is similar to that described for kyphosis.

Cubitus, Varus, and Valgus.—These deformities disappear as a rule without special treatment.

Bow-legs (Genu Varum).—This common rachitic distortion may be congenital or it may be an acquired condition. The treatment consists in support and correction by braces.

Whitman believes that correction by osteotomy or osteoclasis is necessary when children are over 5 years of age. For knock-knees braces are usually necessary. The Thomas knock-knee brace is the most efficient. In some cases osteotomy of the femur just above the epiphyseal line is indicated.

Antero-posterior bow-leg can only be corrected by osteotomy.

Genu Recurvatum (Back-knee).—Whitman states that in its most extreme form it is of congenital origin, and is usually associated with defective development of the anterior thigh muscles and of the patella. In such cases the knee is bent directly backward, and the tibia is often displaced forward upon the femur. In the milder types of back-knee there is simply an abnormal or over-extension caused by laxity of the ligaments and supporting muscles. This form is usually secondary. It is often seen in cases of hip disease after prolonged mechanical treatment. It may be associated with congenital talipes, or it may be the direct result of paralysis of the muscles of the legs, or even of general weakness, as in severe rachitis.

The following are the principal points in the differential diagnosis of rickets and Pott's disease:—

TABLE No. 56.

Rickets.	*Pott's Disease.*
Deformity not angular.	Angular.
Result of posture.	Result of lesion.
Evidences of rickets elsewhere.	Absent.
In infancy.	Usually later.
In middle and lower part of the spine.	In any part.
The body may be bent forward without discomfort.	Forward flexion causes pain.
The curve is lessened, or it may be obliterated when the trunk is extended.	Never disappears.

Surgical Treatment.—It is always safe advice to consult a surgeon or orthopædist concerning deformities in early life. Very many rachitic deformities due to softened diapheses can be corrected or modified as described in the treatment previously given. When a brace appears unsatisfactory then surgery may yield excellent service, but surgery must be used in conjunction with proper nutrition and restorative treatment to secure permanent benefit.

ATHREPSIA INFANTUM (INFANTILE ATROPHY, MARASMUS, OR WASTING DISEASE).

This condition is met with as a result of malassimilation of food. It is really a deficient metabolism, and results in a gradual decline. It is important to note that constitutional disorders, such as tuberculosis or syphilis, are not the causative factors.

When the digestive function is impaired and food is not assimilated, then wasting follows. An inquiry into the cause leading to this disturbance is naturally of interest, as thereby we can frequently find therapeutic measures necessary to modify and frequently to cure this disease.

Etiology.—What are the causes?

1. Improper food. *(a)* Over-feeding; too rich food. *(b)* Underfeeding; lack of nutriment.
2. Bad hygiene.
3. Too frequent feeding; improper quantity.
4. Congenital defects. *(a)* Harelip. *(b)* Adenoids.
5. Inherited diseases.
6. Improper development. Premature birth and its consequent subnormal digestive powers.
7. Sequelæ to acute infections; subsequent paralysis preventing proper digestive functions.

Henoch does not like the term "athrepsia" introduced by Parrott, but prefers "atrophy." The first symptom that this author noticed is that the child's weight does not increase; hence he emphasizes the importance of frequently weighing children. He regards the weight taken once a week as sufficient, so that it can be the determining factor as to the progress made by an infant. Henoch says that at the end of the first month the weight is increased one-third, at the end of the fifth month it is double, and at the end of the twelfth month it is three times the weight at birth. Weaning, dentition, and all other pathological conditions interfere with a proper increase in weight.

By far the greatest number of cases of athrepsia are found in bottle-fed children. There are, however, a great many cases to be seen among breast-fed children. We can then be positive that the breast-milk is lacking in some of its chemical constituents, and frequently we find that it is the proteids that are deficient in quantity. If, therefore, we meet with a case of athrepsia in a breast-fed child, the thing to do is to have a chemical examination made of the breast-milk. If it is found deficient in quality, then we must withdraw it and substitute bottle-feeding.

A great many children will be found to thrive at once after having been removed from the breast and changed to some artificial mode of feeding, whereas the reverse is also true. If we wish to discard the mother's milk, for some positive reason, then it is advisable to secure a wet-nurse having a child as near as possible to the age of the one she is about to suckle. The hereditary history of a nurse is of great importance, as is also the quality and quantity of her milk, which should be thoroughly examined before she is given this foster-child. (Read chapter on "Wet-nurse.")

Pathology.—There are no distinct lesions which can be called specific in marasmus. In some there may be a fatty liver associated with a general tuberculosis. The brain is commonly anæmic with dark fluid blood in the sinuses, marantic thrombi being rare. In many young infants areas of atelectasis are found in the lower lobes. The heart, spleen, and kidneys are pale, but otherwise normal. The solitary follicles of the colon, the small intestines, and some times Peyer's patches are slightly enlarged, the mucous membrane in other respects being normal. The mesenteric glands are often slightly enlarged (Holt). The true pathology seems to be a failure to assimilate food in infants with improper hygiene, and as a result progressive emaciation takes place.

Symptoms.—When infants suffer with vomiting or diarrhœa, and this condition is allowed to become chronic, then colic and flatulence, associated with constipation, supervene, and the result is a gastro-intestinal catarrh. Neglect of this condition means the development of the condition known as athrepsia. The infant does not thrive, commences to waste, and unless we realize the condition and give the baby proper treatment, such a child will die from exhaustion and from inanition. When these cases linger for months they develop rachitis. Recovery without treatment is impossible. Parrott was the first to define this disease and classify it into three stages:—

1. The infant suffers from a simple diarrhœa or looseness of the bowels. The stools, instead of being bright yellow and homogeneous, are liquid, curdy, often of a greenish color, and contain an excessive quantity of mucus. The abdomen is distended with gas and remains constantly in this condition. The tongue is coated and the patches of a stomatitis appear in the mouth. The infant is restless, constantly whining, and will not sleep at night. The milk, being retained, curdles; the tissues become flabby, and wasting commences.

2. The symptoms are intensified and the characteristic wasting becomes manifest. The stools, for the most part, are loose and frequent, and consist of undigested food. The stools are frequently pale and putty-like, with a peculiar odor. At other times they are dark brown from the presence of altered bile. The infant is most voracious, liquid food does not seem to satisfy it, and by the mistaken kindness of its friends it is fed with some thick food like soft bread, a diet which has the great advantage in their eyes of keeping it quiet for a longer time than liquid food or diluted milk. At times it can hardly be made to sleep, or only dozes for a short

time, unless under the influence of a soothing syrup given by its nurse. The mouth becomes the seat of a parasitic stomatitis; the skin is harsh and dry; small boils or a lichenous rash make their appearance. The buttocks and genitals are raw and excoriated. The temperature is below normal; the feet and hands are congested; the face has a pallid, earthy tint, and a sickly lactic-acid smell is given out from the body, especially the abdomen. The wasting is extreme, the face being shriveled, the skin wrinkled and hanging in folds about the arms and thighs.

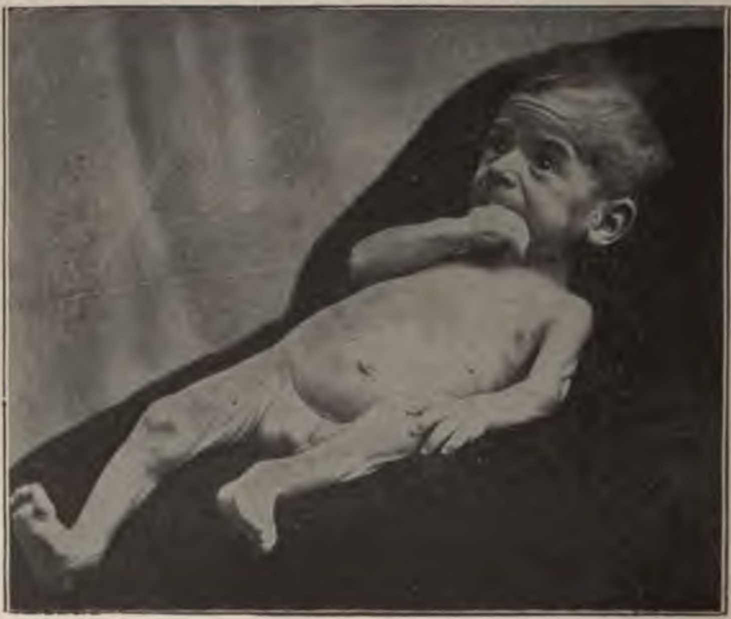

Fig. 108.—Athrepsia Infantum. The loss of fat causes the skin to hang in loose folds. Note the left forearm and both legs. The forehead is wrinkled. The hand in the mouth is a characteristic symptom of starvation. (Original.)

3. The third stage brings the child into a moribund state. It is too feeble to cry, becomes heavy and drowsy, taking little notice of anything. Death then ensues, probably preceded by a muscular twitching, strabismus, or general convulsions.

Prognosis and Course.—The course of this condition depends on the amount of nutrition that can be assimilated. The worst forms of marasmic children will frequently gain in weight when proper food is given. If the appetite is poor a decided change of air, from the city to the country, or *vice versâ,* will strengthen the infant and restore the appetite. Many a child's life has been saved by a trip to the seashore or a sea voyage. The outcome of the case depends on judicious feeding, a change of air, and proper hygienic management.

The treatment of this disease is one that resolves itself into removing the cause, and if bad hygienic surroundings—as impure air, crowded apartments, and improper diet—are the cause, then these must be remedied at once. Medication amounts to nothing in the treatment of this disease. With hand-fed or bottle-fed children we can easily regulate the condition of their bowels, and also easily regulate the quantity and the quality of food given them. The blandest and least irritating food must be selected, while frequent weighing of the infant should be resorted to in order to ascertain the progress that is being made.

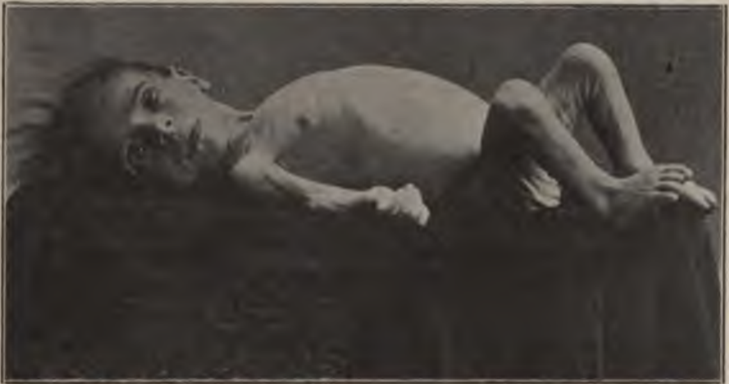

Fig. 109.—Athrepsia Infantum. The emaciation is seen on the neck, right arm, the thighs, and legs. The tendons on the right foot are plainly seen. (Original.)

In some children milk or milk foods are badly assimilated and gastric symptoms follow; it may be wise to discontinue milk for several weeks. By this means we give the stomach absolute rest and can order food that is more easily assimilated until such time when milk may again be tolerated. My plan has been to order whey made by straining the curd out of milk (see "Dietary"); 6 to 8 ounces of whey may be given, to which the yolk of a raw egg may be added. Concentrated chicken soup thickened with sago, farina, or barley may be given in quantities of 4 to 6 ounces, alternating with whey. A child of 1 year may be fed every three hours if marked emaciation exists. The value of vegetable soups, such as pea, bean, or lentil soup, strained, must not be forgotten. Roasted flour made as a flour ball (see page 77) may be added in the proportion of a teaspoonful to 4 or 6 ounces of soup. An emulsion of sweet almonds may be tried as a valuable and nutritious vegetable proteid. Steak juice, roast beef juice, or beef blood is indicated in doses of 2 to 6 ounces once or twice a day.

Where there is much diarrhœa milk must be used sparingly or altogether omitted for a while, as the hard curds formed in the stomach are beyond the feeble digestive powers of the weakened stomach and intestines. Small quantities of whey and barley water, yolk of egg and barley water, or the juice of a rare chop or steak may be given at short intervals during the day and night.

As soon as the child improves in respect to the diarrhœa, milk in some form may be allowed. Peptonized milk is often of much value in these diseases when made by mixing 3 ounces of cold milk, adding 2 tablespoonfuls of cream, with half of a peptonizing powder. In addition to the above the white of a raw egg or the yolk of an egg may be well beaten up with water and given in teaspoonful doses. When the stomach rejects all food, rectal feeding may be resorted to (see chapter on "Rectal Feeding"). High saline injections will be urgently called for in this wasting condition. They may be repeated, if beneficial, two or three times a day. Several pints of saline solution may be slowly injected.

Restorative treatment will consist in giving small doses of codliver-oil, iron, malt, and arsenic if the stomach will tolerate the same. The inunction of warm codliver-oil over the entire body every morning, is frequently of service. The outcome of the case usually depends on perseverance and judicious feeding.

Marasmic and atrophic children do well on Keller's malt soup.[1] This preparation has been used by me with very good result. When it was difficult to prepare this food the following formula served me equally well:—

Raw cows' milk	4 ounces
Maltine, plain	1 teaspoonful
Bicarb. of potassium	20 grains
Eskay's food	2 teaspoonfuls
Rice water	4 ounces

Mix the above and heat slowly for three minutes until it boils. Allow it to boil one minute. Feed every three or four hours. If the food agrees well *add one-half ounce of milk* more every four days. The Eskay's food should also be increased until three teaspoonfuls are given with each feeding. If the child vomits reduce the quantity of maltine to one-half teaspoon.

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[1] Formula of Keller's malt soup. See page 170.

PART V.

DISEASES OF THE HEART, LIVER, SPLEEN, PANCREAS, PERITONEUM, AND GENITO-URINARY TRACT.

CHAPTER I.

INTRODUCTORY.

The Heart and Fœtal Circulation.

The circulation of the blood during the whole fœtal period of antenatal life is the same. From the third to the tenth month the circulation is known as "placental," and during the intervening months it undergoes no marked modifications.

According to Ballantyne[1] during the neo-fœtal period, it is true the circulation is that of the chorion; but by the end of it there has been a specialization of the circulatory function, and the blood, instead of being sent to the villi over a wide expanse of chorionic surface, is now directed solely to those found over one part of it, that, namely, which is in contact with the decidua serotina, the site of the developing placenta. From the end of the neo-fœtal period onward to the moment of birth, there is the circulation of the placenta.

The essential peculiarity of the placental circulation is the sending of the fœtal blood out of the fœtal body to a specially prepared and extra-corporeal organ (the placenta) for purposes of oxygenation and other less understood chemical changes. This entails simply the presence of an efferent vessel (or vessels) to carry the blood to the extra-corporeal organ and of an afferent vessel to bring it back again.

Changes at Birth.—When the umbilical cord is ligated there is an interruption of the circulation through the umbilical vein and arteries, so that in about ten days after birth the circulation loses its fœtal type and assumes extra-uterine conditions.

The following physiological changes occur:—

(a) The conversion of the ductus arteriosus.

(b) The ductus venosus into fibrous cords.

(c) The closure of the foramen ovale.

(d) Changes in the umbilical veins and umbilical arteries. The first forming the round ligament of the liver, the second the true anterior ligament of the bladder and the superior vesical arteries.

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[1] For those interested I would advise reading Ballantyne's book on ante-natal pathology and hygiene.

For some weeks before birth the circulation through the foramen ovale is slight, it being gradually obstructed by the growth of a septum which nearly fills the space at birth. After the first week of extra-uterine life, very little if any blood passes through it, although complete closure of the foramen often does not take place until the middle of the first year. In one-fourth of the autopsies Holt made upon infants under six months of age, minute openings at the margin of the foramen ovale were found. They were usually oblique, and closed by the valvular curtain so as to effectually obstruct the current of blood. The ductus arteriosus is first closed by a clot, which becomes organized and blends with the products of a proliferating arteritis. It is rarely found open after the tenth day, and by the twentieth it is almost invariably obliterated.

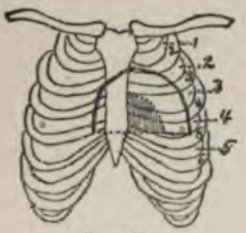

Fig. 110.

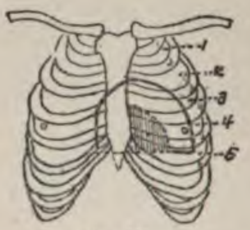

Fig. 111

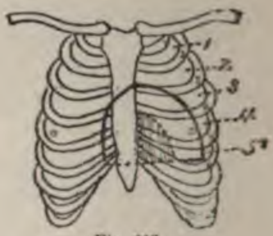

Fig. 112.

Fig. 110.—Note the Position of the Apex Beat in a Very Young Infant; during the first year it is very high, between the fourth and fifth intercostal spaces. It is most often in the fourth.

Fig. 111.—The Apex Beat in a Child About 6 Years Old. It is lower than in an infant. Usually found at the fifth intercostal space.

Fig. 112.—The Apex Beat in a Child About 12 Years of Age is found between the fifth and sixth intercostal space.

The heavy black lines denote the area of relative dullness. The small shaded areas denote the area of absolute dullness. (After Unger.)

THE HEART.[1]

Size of the Heart.—The relative size of the heart is greater in children than in later life. It is smallest about the seventh year.

TABLE No. 57.—*Weight of the Heart (Boyd).*

Age.	Grams.
At birth	20.6
One and one-half years	44.5
Three years	60.2
Five and one-half years	72.8
Ten and one-half years	122.6
Seventeen years	233.7

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[1] Heart murmurs are described on page 366.

The anatomical differences in the child are:—

(*a*) A more horizontal position of the heart than in the adult.

(*b*) The diaphragm being higher, the heart is higher in the thorax.

(*c*) The ribs in a child are more horizontal than in the adult.

(*d*) The liver in young children is larger than in adults, and as the heart is in close contact with the liver the area of cardiac dullness merges into that of the liver dullness below.

Tension.—The degree of contraction of the vascular muscles determines the size of the artery and (to a great extent) the tension of the blood within it. But if the heart is acting feebly there may be so little blood in the arteries that even when tightly contracted they do not subject the blood within them to any considerable degree of tension. "To *produce high tension,* then, we need two factors: a certain *degree of power in the heart-muscles,* and contracted arteries. *To produce low tension* we need only *relaxation of the arteries,* and the heart *may be either strong or weak.*

"*The pulse of low tension* collapses between beats, so that the artery is less palpable than usual or cannot be felt at all. Normally, the artery can just be made out between beats, and any considerable lowering of arterial tension makes it altogether impalpable except during the period of the primary wave and of the dicrotic wave, which is often very well marked in pulses of low tension."

"*The pulse of high tension* is perceptible between beats as a *distinct cord which can be rolled between the fingers,* like one of the tendons of the wrist. It is also difficult to compress in most cases, but this may depend rather on the heart's power than on the degree of vascular tension. The pulse wave is usually of moderate height or low, and falls away slowly with little or no dicrotic wave.

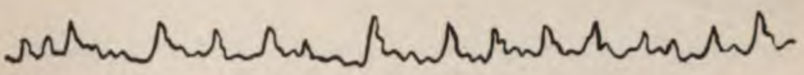


Fig. 113.—Irregular Pulse, Low Tension, from a Case of Mitral Regurgitation. (Original.)

Mode of Examination of the Heart.—The ear should be used, rather than an instrument in listening to the heart sounds in struggling children. In children with eruptive fevers it is safer to use a phenendoscope. For this purpose the Bowles phenendoscope (Fig. 114) is highly recommended, as it has a flat attachment which can conveniently be placed in the axilla or to the posterior portion of the lung without raising the child from the bed. These advantages are important inasmuch as we frequently can examine the child while asleep.

The following aphorisms are drawn from Crandall:

1. The apex lies higher in the chest and further to the left than in the adult.

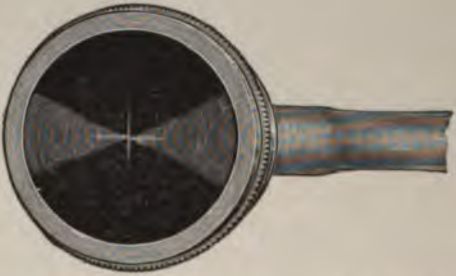


Fig. 114.—Natural Size of Bowles Stethoscope for Examining Children.

2. The apex beat is hard to detect in the infant. In the child palpation shows this easier than in the adult.

3. The area of dullness is comparatively large. (There are three stages in infancy and childhood during which differences are noted in relative and absolute dullness.) (See Figs. 110, 111, and 112.)

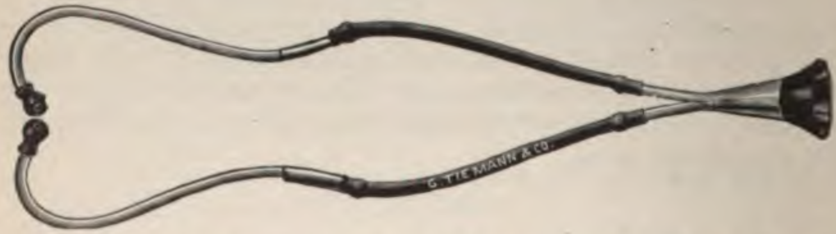


Fig. 115.—A Convenient Stethoscope for Children. Made by G. Tiemann & Co. and by George Ermold, New York City.

4. Murmurs are heard over comparatively large areas. A study of differences in the quality of the sounds and points of greatest intensity will help us here.

5. The rate may be increased and the rhythm altered by slight causes.

6. In rachitic children and in those affected by empyema or pleural effusions and adhesions the apex may appear in an abnormal position.

7. Prominence of the precordia is sometimes marked. Normally the loudest sound is the first sound at the apex; the weakest sound is the second sound at the aortic cartilage. This accords with my experience,

though it does not seem to be generally recognized that the pulmonic second sound is in early life stronger than the aortic sound.

TABLE No. 58.—*Classification of Cardiac Diseases.*

Time of Occurrence.	Nature of the Affection.		Clinical Disease.
Intra-uterine existence or very early infancy.	Developmental or Inflammatory.		Various congenital affections.
Extra-uterine existence (infancy or childhood).	Various motor or sensory phenomena unaccompanied by sensible changes of structure.		Functional diseases of the heart.
	Organic,	Mechanical.	Dilatation, Hypertrophy, Alone or as accompaniment of inflammatory change.
		Inflammatory.	Pericarditis, acute or chronic. Endocarditis, acute or chronic. Myocarditis, acute or chronic.
	Miscellaneous.		Effusions (non-inflammatory). Granulomata. Neoplasms.

CHAPTER II.

DISEASES OF THE HEART.

REFLEX SYMPTOMS OF THE HEART.

Tachycardia.—Severe palpitation of the heart (tachycardia) frequently results from excitement or fright in children. The heart on auscultation will be found normal, and the only symptom noticeable will be an exaggerated pulse-rate with an increase of twenty to forty beats per minute. It is usually a neurotic manifestation. As a rule the prognosis is good. The treatment consists in removing the cause if possible.

Bradycardia.—A slowness of the heart's action and a slow pulse-rate is occasionally met with in children. It may occur in health, although very rarely without pathological significance. I have usually seen bradycardia in septic cases of diphtheria at my service in the Willard Parker Hospital, and in the septic type of scarlet fever at the Riverside Hospital. When bradycardia is seen during the course of acute infectious diseases it should be regarded as a very serious symptom (see chapter on "Diphtheria").

POINTS TO BE NOTED IN THE DIAGNOSIS OF DISEASES OF THE HEART.

HEART SOUNDS AND MURMURS.

First Sound.—*In infectious fevers* there is an increase in the length and intensity of the first sound heard at the apex.

In continued fevers causing degeneration of the heart muscles there is a shortening and weakening of the first sound heard at the apex.

In exhaustive heart strain seen in myocarditis the first sound is feeble and merges into the second sound. This condition is met with in diphtheria, scarlet fever, and typhoid, although any disorder of the body which devitalizes may cause it.

Fatty heart, emphysema or *pericardial effusion* may give a feeble mitral first sound.

Pulsus Paradoxus.—The heart-beats during inspiration are more frequent but less full than during expiration. This condition may be observed in healthy children during sleep.

An irregular heart's action may occur during sleep in healthy children. The heart's action is frequently influenced by inspiration and expiration.

Systolic Murmurs.—There are two murmurs possible for each orifice, or eight in all. Of these, four, namely, mitral systolic, mitral presystolic, aortic systolic, and aortic diastolic, are most likely to occur, with a frequency about in the order of their enumeration. The necessary changes being made, a like distribution applies to the right side; although a pulmonary lesion is almost unknown, except as a congenital affection, while disease of the tricuspid valve is less rare.

Every murmur is determined by the time of its occurrence, the direction which it takes, and the location of its greatest intensity. The blood is driven from the left ventricle, during systole, through the aortic orifice; and, meanwhile, all communication with the auricle of this side is cut off by a closure of the mitral valve. But should the current encounter an obstacle at the aortic opening in its onward course, it would be thrown into confusion in the aorta, from which a murmur would arise and be carried upward. Hence this bruit is loudest at the aortic area, systolic in rhythm, and extends in the direction of the carotids.

Should the mitral valve fail to close at this time the blood would escape into the left auricle, as well as run through the proper channel, and be set in vibration by the impeding flaps at the mitral orifice. Here the bruit generated by this disturbance is borne with the reflux into the auricle, and thence to the back, and also by conduction through the apex to the front. Moreover, it is *loudest in front and at the apex,* because the heart is nearer the anterior than the posterior surface of the chest. Therefore, this murmur is most *intense at the mitral area, systolic in rhythm, commonly diffused to the left, and often audible near the inferior angle of the left scapula.*

In a similar manner during systole, the blood is being propelled by the right ventricle through the pulmonary aperture, and likewise the tricuspid valve is closed or very nearly so. Thus supposing that an *obstruction were to occur at the pulmonary orifice,* there would be a *systolic murmur, with point of maximum intensity in the pulmonary area and extension upward to the left, but not into the carotids.*

In the event of *tricuspid insufficiency,* part of the blood would flow back into the right auricle, and give rise to a *systolic bruit, best heard in the tricuspid area,* and *spreading upward to the right.*

Anæmic Murmurs.—An anæmic murmur is always systolic in rhythm, loudest at the base of the heart, and often as audible in the aortic as the pulmonary area. With anæmia pure and simple there should be no cardiac hypertrophy.

Diastolic Murmurs.—In diastole the aortic and pulmonary valves are closed, and the auriculo-ventricular valves open, while blood is flowing from the auricles to the ventricles. The vermicular contraction, styled cardiac systole, which was initiated in the veins and taken up by the auricles, has gone through the ventricles and reached the large arteries, wherein the recoil of the current finds a point of support at the closed semilunar cusps.

If the function of one or more of these cusps in the aortic valve be destroyed, each contraction of the artery will drive a portion of its contents back into the left ventricle; and the vibrations generated in this return stream against the disorganized valve will cause a bruit that is *aortic* in origin and *diastolic* in rhythm.

Though this murmur of insufficiency is conveyed along the arteries a varying distance in the efflux, its main direction is backward with the reflux; not so much in the line of the ventricle as down the sternum, owing to the close proximity of this bone to the aortic valves, and its superiority over the heart as a conducting medium of sound. *The point of maximum intensity of this bruit is more often at the lower end of the sternum than in the second intercostal space.* Granting that the same thing could happen to the pulmonary valves, a *diastolic murmur would be audible in the pulmonary area, but with an extension downward only.*

An *aortic systolic murmur is loudest in the second right intercostal space close to the sternum,* and a *diastolic bruit is heard loudest at the lower extremity of this bone.* In some instances these murmurs are heard only at mid-sternum, about on a level with the third costal cartilages. In others they are most intense in the second, and even the third intercostal space, close to the left edge of the sternum. Upon the exclusion of aneurism, a bruit within these precincts is presumably aortic and not pulmonary, especially if the right ventricle is unenlarged.

Pericardial Murmurs.—A pericardial is distinguished from a pleuritic friction mainly by the time and locality of its occurrence. *Grating in the pericardium obviously is limited to the præcordial region, and is regulated by the action of the heart.* That of the *pleura* is most prone to take place *in the infra-axillary regions,* where pulmonary mobility is extensive. *It is dependent upon the respiratory movements.*

Venous Murmurs.—In quality venous murmurs are blowing, cooing, and sometimes musical; and from the frequent resemblance of the noise to that of a humming-top, it has been denominated *venous hum.*

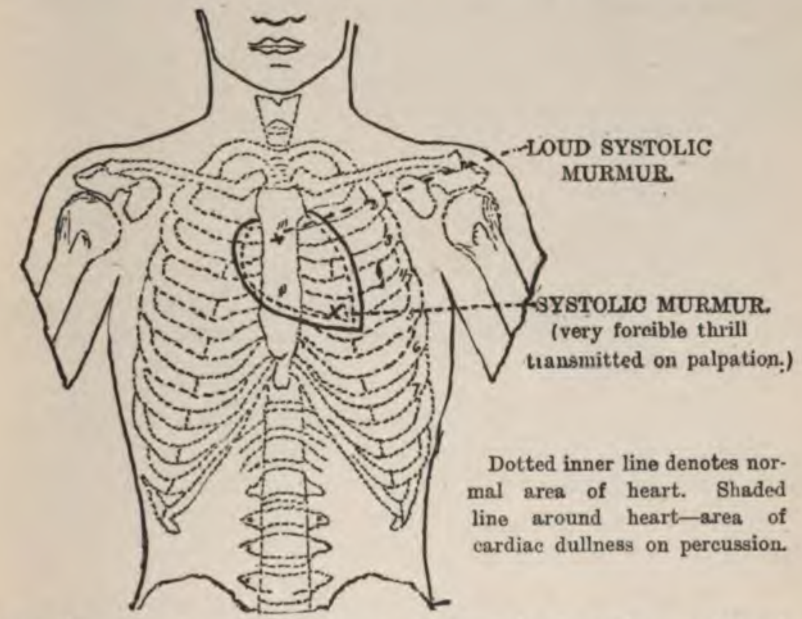
It is usually most *distinct at the lower third of the external jugular veins, and more distinct in the right than in the left side.* It is always continuous in rhythm, but the intensity is often remittent because of the periodical acceleration of the stream by the action of the heart. The direction is downward and inward along the subclavian and right innominate veins, so that it is now and then audible through the aortic area, and can be separated with a little care from the aortic sounds as well as from the respiratory murmur. *When there is a question as to whether or not a given bruit is venous or arterial, pressure upon the vein above the stethoscope will stop the downward current and silence the venous hum.*

Cerebral Blowing.—A blowing, systolic murmur, of variable intensity, is frequently heard over the anterior fontanel and sometimes over the carotids of children, between the ages of three months and six years.[1]

PULMONARY STENOSIS (CONGENITAL HEART LESION: BLUE BABY).

A. N. H., born May 7, 1904, was first seen by me when seven months old, in consultation with Dr. E. D. Lederman.

Family History.—It was the third child born with natural labor. The mother has had one still-birth and one miscarriage. Has one child 5 years old in good health with no evidence of heart trouble. Both father and mother are in excellent health, and there is no evidence of heart or lung trouble, and no specific disease on either side. This child has been cyanotic. The toe nails and finger nails show typical clubbing and also blueness. On the slightest exertion the infant's skin assumes a very dark blue color. Dyspnœa is also present. The cutaneous circulation is very poor and the nurse informed me that for one-half hour after a tub bath there is an increased evidence of cyanosis.


LOUD SYSTOLIC MURMUR.
SYSTOLIC MURMUR. (very forcible thrill transmitted on palpation.)

Dotted inner line denotes normal area of heart. Shaded line around heart—area of cardiac dullness on percussion.

Fig. 116.—Case of Pulmonary Stenosis—Congenital—Blue Baby. (Original.)

A loud blowing systolic murmur could be made out in the second intercostal space. There was also a weakness of the pulmonary second sound. The area of dullness was increased so that a right-sided hypertrophy undoubtedly existed. The murmur was not transmitted to the vessels of the neck.

The infant was breast-fed by its mother for four and one-half months. There has been a tendency to constipation. The stool has been green and contained white curds at times. During the last few months the feeding consisted of equal parts of barley water and milk. When seen again the appetite was poor. The tongue slightly coated. The general condition one of restlessness by day and insomnia by night. The infant was very sensitive to cold and had a diffuse bronchitis associated with acute rhinitis. I ordered:—

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[1] I am indebted to S. S. Burt & E. Le Fevre for some points in the above article.

℞ Raw milk	12 ounces
Rice water	24 ounces
Granulated sugar	6 drachms
Lime water	6 drachms
Peptogenic milk powder	2 measures

Divide in six bottles. Feed every 3 $^1/_2$ hours.

As the food agreed very well, I ordered 1 ounce more of milk to the total quantity every second day until the infant received full milk undiluted.

I ordered to relieve the dyspnœa and regulate the heart:—

℞ Sodium iodide	15 grains
Sparteine sulphate	3 grains
Elix. lactopeptin	2 ounces

Half teaspoonful three times a day.

The progress of the case was excellent. When first seen by me there was no evidence of dentition. At the ninth month the child had two teeth and showed signs of general development.

Prognosis.—As a rule the outcome of these cases is bad, although I have known a child with a pulmonary stenosis for the last twelve years. He is now 18 years old and is able to do light work. These cases have a tendency to pulmonary disease, and are especially prone to develop tuberculosis.

Persistence of the Ductus Arteriosus Botalli.

During the first four weeks after the birth of an infant, the ductus arteriosus is closed by an overgrowth of the cells in its inner wall. When abnormal conditions exist, such as septic infection of the new-born with thrombi, a breaking down of the cell growth takes place and results in the duct remaining patent. This may also result from defective respiration and an anomalous pulmonary circulation.

The clinical symptoms of the patency of the ductus arteriosus are rapid hypertrophy and dilatation of the right ventricle, with co-existing dilatation of the pulmonary artery. There is also an increased area of cardiac dullness. Loud systolic murmurs are heard all over the chest and a thrill of the anterior chest wall can be felt. Protrusion of the upper part of the sternum—dyspnœa rarely—cyanosis and a deathly pallor.

Gerhardt states that dullness is found at the border of the second rib; in which region the systolic pulsation of the pulmonary artery can be felt.

M. G., four months old. Was two weeks prematurely born. She was the second child. The first child died of diphtheria; it was also prematurely born, and died when its mother was four months pregnant with the present baby. The mother had a normal pregnancy, but was greatly troubled with headaches and dizziness, and suffered mentally over the loss of the first child.

The Baby.—When the baby was six weeks old the mother first noticed that it breathed with difficulty. It had been vomiting continuously. Diarrhœa has existed for ten weeks. There is an occasional cough. Since two weeks the baby appears colicky and cries with apparent pain.

Stat. Præs.—A pale, very anæmic looking child, with large fontanel, somewhat depressed, the size of a silver quarter.

The Eyes.—There was a slight exophthalmus. The nose, somewhat depressed. Slight coryza.

The Heart.—The area of dullness extends from the right side to the left border of the sternum, corresponding to the lower border of the third rib. The apex is at the lower border of the fifth rib, immediately under the mamilla. The heart is somewhat enlarged toward the left side.

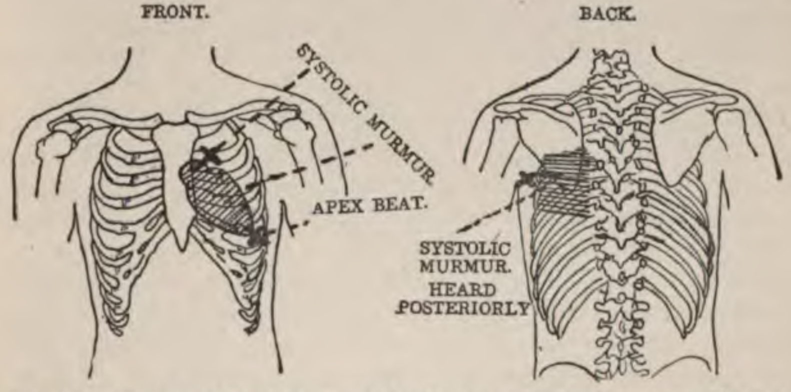

Fig. 117.—Child with Persistence of the Ductus Arteriosus Botalli. **X** Loud murmur audible—blowing presystolic. (Original.)

Auscultation.—A loud presystolic murmur is heard over the whole area of the heart. There is marked abdominal respiration. The lungs are normal in percussion. Moist râles can be heard over both lungs.

The Abdomen.—The abdomen is distended and is tympanitic on percussion. It feels doughy on palpation. There is no cyanosis of the fingers or toes. There is a mild dyspnœa. The adipose tissue is not very apparent. There is marked prominence of the subcutaneous veins of the scalp.

The clinical history of the mother did not give any evidence of miscarriage, no syphilis, and no family tuberculosis.

ENDOCARDITIS.

This disease is of frequent occurrence during infancy and childhood. Congenital endocarditis has frequently been reported, so that it is assumed it must have existed during fœtal life.

Etiology.—Gerhardt and Bednar believe that the disease occurs quite frequently in young children, although the greatest frequency is noted between the sixth and the twelfth years. Acute rheumatism is very frequently followed by endocarditis. Chorea is also frequently accompanied by endocardial disease. Scarlet fever, measles, variola, varicella, diphtheria, typhoid, and tuberculosis, according to Reimer, are frequently followed by or associated with endocarditis. When endocarditis follows pneumonia, pleurisy, or bronchitis, it is due to the invasion of pathogenic bacteria. These are the staphylococcus, according to Frankel and Sanger, and the pneumococcus, according to Netter and Weichselbaum. The germs enter the deeper portion of the pericardium through the epithelium, causing inflammatory conditions. It is quite likely that endocarditis is caused by such invasion in acute joint inflammations, in phlegmonous periostitis, lymphangitis, pericarditis, myo-carditis, and puerperal infections. Bouchut has reported cases of endocarditis following erythema nodosum and hereditary syphilis. Von Dusch has reported endocarditis following extensive burns of the hand.

Pathology.—The lesions occur most frequently on the valves of the heart. The valves on the left side of the heart are most frequently affected, hence, the mitral is the seat of the lesions more often than the aortic valve. In studying a series of these cases given by Steffen, we find that about 4 per cent. show lesions in the aortic valve.

The pathological changes consist in hyperæmia, swelling, and an infiltration of normal cells or new connective tissue cells having a grayish-white color. There is a breaking down of the epithelium besides wart-like excrescences called vegetations are formed on the free border of the thickened valves (endocarditis verrucosa). The result caused by the last-named condition is that the vegetations prevent a proper closing of the valves, which latter results in insufficiency and stenosis. Fibrinous deposits are frequently noted on the valves, and on being carried with the circulation may lodge in the cerebral arteries, causing either emboli or infarctions, according to Virchow. The last-named condition is exceptional in acute endocarditis.

Symptoms.—Endocarditis, whether primary or secondary, begins with fever. Not infrequently the temperature rises to 102°, sometimes 103° F., and there is a corresponding increase in the pulse-rate. The pulse is rapid, irregular, and of low tension. Cyanosis is sometimes present, especially so if myocarditis accompanies the attack. Sometimes a child will develop endocarditis without any special symptoms being present. Not until the heart is examined will the condition be diagnosed. Thus an important rule which has been previously mentioned is the necessity of always listening to the heart when a diagnosis is uncertain. Frequently a few days will pass without specific symptoms being recognized. A child will show evidence of malaise and suddenly the characteristic blowing systolic murmur will be heard at the apex. The murmur is usually transmitted to the left and can also be heard behind. It is frequently accompanied by the thrill and by an accentuated pulmonic second sound. When dilatation results there will be a cardiac insufficiency. The murmur may gradually increase in intensity and in the same manner it may diminish until it is inaudible. When fever suddenly appears during the course of an attack of chorea, endocarditis should be suspected. In some cases dyspnœa may be present.

The diagnosis is frequently obscure because a child will have no symptoms of a definite nature. If, however, we are patient and carefully examine the heart, we may be rewarded by making the diagnosis. It is important to examine all the organs of the body before making a positive diagnosis, if obscure or no cardiac symptoms exist.

Inspection will always show a rapid and diffuse apex-beat.

Palpation will confirm this observation and may reveal a strong but irregular heart action.

Percussion is usually negative.

Physical signs are due to (*a*) insufficiency, (*b*) roughening, (*c*) stenosis, depending on changes in the valves. The character of the murmur depends on the valve involved and the lesion of the valve. In *mitral regurgitation we have a systolic murmur with greatest intensity over the apex*. It is *usually transmitted to the side, and also heard behind the sternum.*

In *mitral stenosis we have a presystolic murmur with the greatest intensity over the mitral area.*

In *aortic regurgitation we have a diastolic murmur with the greatest intensity over the aortic valve, and transmitted down the sternum.*

In *aortic roughening we have a systolic murmur with the greatest intensity over the aortic valve.* Distinct murmurs can be heard at the valves of the right side.

An embolism in some portion of the body is frequently the sign of a heart lesion. If the embolus reaches the brain, hæmiplegia is the usual result. If it reaches the lungs severe dyspnœa may result. An embolus in the mesentery may result in diarrhœa. If in the kidneys, hæmaturia may result. When it reaches the limbs it means an obstructed circulation.

Prognosis and Course.—Endocarditis if carefully managed with rest and strengthening diet will improve. I have seen children with endocardial murmurs improve after a few weeks, when put to bed amid quiet surroundings. As a rule the prognosis is bad and the course of the disease tends to become chronic. In giving an opinion as to the outcome of a case of valvular lesion, we must remember that we are dealing with a damaged heart, and that months or years may pass before recovery can take place. A fatal outcome will be the result of carelessness or mismanagement.

Treatment.—Nothing will do more good than absolute rest in bed. Small doses of codein or Dover's powder act very well. If endocarditis accompanies or follows rheumatism then the salicylates should be given. An ice-bag over the heart is frequently useful. If the pulse is very rapid or the heart's action is feeble, then digitalis or strophanthus should be given.

The tincture or an infusion of digitalis made from English leaves is the best. A point to remember is that digitalis has frequently an accumulative effect so that the pulse must be carefully guarded during its administration. When this is the case the administration of the tincture of strophanthus will be found very serviceable. In some children digitalis will be badly borne owing to its irritant action on the gastric mucous membrane. In such cases sparteine or strophanthus should be prescribed.

Adrenalin chloride solution taken internally increases the blood pressure, stimulates the heart, and retards the pulse-rate. It is better than digitalis, as it does not irritate the gastric mucous membrane, and it is non-cumulative.

℞ Sol. adrenalin chloride 1-1000

Infants of 1 year, 1-5000, made with normal saline solution.

Dose: Five to 10 drops, three times a day, gradually increased until effect on pulse is manifested.

In some cases marked benefit will follow the use of iodide of sodium in doses of 1 to 5 grains, according to age. The iodides seem to steady the heart's action. I have found excellent results following their use.

MALIGNANT ENDOCARDITIS.

This is commonly called ulcerative endocarditis. It is a rare condition in childhood. Harris reports a case in a child 4 years old. The type of the disease is similar to that noted in adults. This condition is rarely primary. It occurs with scarlet fever, erysipelas, pneumonia, rheumatism, and septicæmia, in which bacterial invasions of streptococci or pneumococci occur. These germs are found in the endocardium.

Pathology.—Vegetations usually occur with ulcerations in the cavities and on the valves. Suppuration of the deeper tissues with abscess formation is frequently noted. Osler states that the different parts of the heart are affected in the following manner: mitral valve, aortic, mitral and aortic combined, tricuspid and pulmonic valves, and the cardiac wall. The secondary lesions of malignant endocarditis are due to emboli. These are most frequent in the spleen and kidney, next in the brain, intestines, and skin, and, if the right side of the heart is diseased, in the lungs. These emboli lead to the formation of red or white infarctions, to hæmorrhages, or to multiple abscesses in the various organs and tissues in which they lodge.

Symptoms.—It is extremely difficult to diagnose malignant endocarditis. The presence of symptoms of pyæmia or septicæmia, associated with a heart murmur, usually renders the diagnosis positive. There is a remittent type of fever, occasionally delirium and extreme prostration. The cerebral symptoms frequently suggest meningitis. There is sometimes a faint mitral regurgitant murmur. Not infrequently it is entirely absent. The spleen is usually enlarged. Hæmiplegia as well as hæmaturia and rapid swelling of the spleen, or possibly symptoms of pneumonia, are frequently the result of emboli.

Diagnosis.—This is at times extremely difficult. An examination of the blood for plasmodia will usually be the means of excluding malaria if the same is suspected.

Prognosis and Course.—The rapidity of the onset and the malignancy of the disease go hand in hand. The outcome is usually fatal.

Treatment.—In addition to rest and a supporting, stimulating diet, nothing but relief of individual symptoms by routine treatment can be given.

PERICARDITIS.[1]

This disease may exist with or without myocarditis or endocardial involvement. Large effusions occur more readily in children than in adults.

Etiology and Causes.—Rheumatism is the most frequent cause of pericarditis. Apparent mild forms of rheumatism, such as are frequently called "growing pains" by the laity, are quite often complicated by pericarditis. In this manner the existence of the rheumatism preceding the pericarditis is strikingly brought out.

Pericarditis is rarely a primary condition. Septic infection of the umbilicus occasionally causes this condition.

Tuberculosis, scarlet fever, diphtheria, measles, typhoid, and influenza frequently precede a pericarditis.

Baginsky found purulent pericarditis associated with phlegmonous erysipelas, grave forms of angina, caries of the ribs, fibrinous pneumonia, broncho-pneumonia, gastro-enteritis, furunculosis, phlegmon of the throat, and empyema. It not infrequently follows kidney disease and scurvy.

Pericarditis is met with at any age. It has been met with in the fœtus according to Billard, Bednar, Hüter, and Steffen.

Bacteriology.—We most frequently meet with a staphylococcus aureus or streptococci, bacterium coli, and the diplococcus pneumonia.

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[1] The anatomical outlines are illustrated and described in the article on "The Heart and Circulation." See "Introductory," Part V.

Pathology.—Pericarditis may be divided into:—

(a) Plastic pericarditis.

(b) Pericarditis with serous or purulent effusion.

(c) Adherent pericarditis.

Any of the above-mentioned varieties consists of an inflammatory affection involving the serous covering of the heart and its reflection on the inner surface of the pericardial sac.

Symptoms and Diagnosis. — The *acute condition* begins with fever reaching as high as 104° F. in some instances. Associated with this there is pain in the præcordial region. Dyspnœa is present. There may be left pleurothotonos (a bending of the body to one side). The pulse is usually rapid. When there is effusion the child will complain of either very sharp pains or merely a sense of heaviness and discomfort. Syncope, singultus, and severe manifestations are present in the severer types of the disease. Not infrequently there may be delirium, twitching, and cerebral symptoms simulating meningitis. When effusions are abundant cyanosis frequently occurs.

The physical signs resemble those of adults. In dry pericarditis a double friction sound is heard over the præcordial space. The area is small and near the base of the heart. The sound is not transmitted and is independent of the respiratory movement. If effusion takes place the apex-beat will be found displaced, sometimes upward and outward or indistinct; in some instances it cannot be found at all. There may be bulging of the chest wall. The intercostal spaces become very prominent. On palpation there is an absence of vocal fremitus over an area usually occupied by the lung.

Percussion gives an area of marked dullness or flatness of triangular shape, the base being below and the apex above. The normal area of cardiac dullness is increased in all directions, and this dullness extends beyond the limits of the heart. On auscultation the heart sounds are feeble and distant. Friction sounds disappear as serum is poured out, and reappear as it is absorbed. Endocardial murmurs may also be pesent. In infants physical signs are often entirely wanting, or the normal sounds may be feeble, distant, or absent.

The usual duration of acute pericarditis is from one to three weeks. The ordinary dry form, with the resulting adhesions, may be followed by a *subacute or chronic form* of the disease. In the sero-fibrinous form the serum is usually absorbed quite promptly, and only adhesions are left or a chronic inflammation follows, with exacerbations in each recurrence of rheumatism. In the purulent form of the disease in young children, death is the most frequent termination. If the pus is evacuated or spontaneous opening takes place, there may be recovery, but always with more or less extensive adhesions remaining.

Prognosis.—The prognosis should always be looked upon as very grave. Steffen states that out of 35 cases, only 6 recovered. When this disease follows pyæmia, or when it is a sequela to the acute infectious diseases, the prognosis is very bad. When it is associated with rheumatism the ultimate result, by reason of adhesions and dilatation, are usually very serious.

Treatment.—Children affected with acute pericarditis should be put to bed and kept quiet. An ice-bag placed over the heart and small doses of opium or Dover's powder seem to steady the heart's action. The value of aconite in this disease must not be forgotten, especially when we have excessive heart's action. Very bad effects have been noted by me when either pilocarpine or jaborandi was given. The specific effect of salicylate of soda, salol, or salophen must be remembered if due to rheumatism.

Aspiration of the Pericardium.—When symptoms of collapse, cyanosis, irregular pulse, and severe dyspnœa are present, then aspiration may do good. If, on aspiration, we find pus present, an incision should be made and drainage should be used as we would in a case of empyema. The proper place to puncture the pericardium is a point a little to the left of the border of the sternum in the fifth intercostal space, the needle being directed upward and outward. It must be remembered that by this means only can relief be expected. Keating states that "of 18 cases punctured only 4 recovered."

CHRONIC PERICARDITIS WITH ADHESIONS.

When children suffer with repeated attacks of rheumatism complicated by pericarditis, a chronic pericarditis frequently remains. Holt describes a case of a child sixteen months old, in which the pericardial sac was completely obliterated. Associated with this condition we frequently have chronic myocarditis, hypertrophy, dilatation, and valvular lesions, so that no portion of the heart muscle or its lining membrane is normal.

Symptoms and Diagnosis.—According to Broadbent there is a contraction seen behind in the infra-scapular region, sometimes on the left, sometimes on the right side, in the region of the eleventh or twelfth rib. Anteriorly we have the characteristic signs. They are a systolic retraction of the chest at or near the apex of the heart, sometimes at the tip of the sternum. This is due to the external pericardial adhesions, and is often better made out by palpation than by inspection. After the systole there is a rapid rebound known as the *diastolic shock*. A collapse of the cervical veins during the diastole of the heart, known as Friedreich's sign, is also seen. Sometimes we see an inspiratory swelling (Kussmaul). In addition the pulsus paradoxus is significant of the presence of pericardial adhesions, or rather of the dilatation that succeeds the adhesions. The pulse is small and feeble during inspiration, assuming greater strength during the period of expiration.

Percussion shows an increase in the cardiac dullness in all directions. The position of the apex and the percussion outline of the heart do not change with the posture of the patient, and the cardiac dullness is but little affected by full inspiration. A systolic murmur is often present. The diagnosis of adherent pericardium always presents difficulties, but it can be made with tolerable certainty in a considerable portion of the cases. On account of the enlargement of the heart and the frequency of murmurs, it is usually mistaken for valvular disease. The lesion is a permanent one and tends to increase. If a child suffers with valvulitis and the *symptoms do not yield to digitalis,* then *adhesive pericarditis should be suspected.*

Treatment.—There is no known method of treatment which will modify or improve this condition, excepting a supporting diet with absolute rest in bed and general restorative treatment. It is very important to watch the emunctories and stimulate them if their action is sluggish.

TUBERCULOSIS OF THE PERICARDIUM.

This condition is rarely met with as a primary process; it is chiefly met with as a secondary process. It usually partakes of a general tuberculous process in which all the organs of the body participate, among them the pericardium.

Diagnosis.—The diagnosis of this condition depends on the symptoms which usually accompany pericarditis. The tubercular nature of the disease must depend on the presence of tubercle bacilli in the exudation, although Unger denies the possibility of making such a diagnosis. Most probably a positive diagnosis will be made as in many obscure lesions—post-mortem.

The treatment is the same as that previously described in the article on "Acute Pericarditis."

HYDROPERICARDIUM.

Occasionally we meet with cases in which the symptoms of dyspnœa and cyanosis rapidly develop. Steffen maintains that such alarming symptoms frequently occur within a few hours, and that the same will sometimes disappear under appropriate treatment in a few days.

Pathology.—A transudation of serous liquid in the pericardium without inflammatory process, is usually a secondary condition in which dropsical effusions appear. Usually hydræmic conditions of the blood, such as the result of long continued fevers in infectious diseases, tuberculosis among others, predispose to this condition.

The prognosis depends upon the cause leading to this condition.

The treatment is chiefly restorative, and will depend on maintaining the strength of the child by careful diet and hygiene.

MYOCARDITIS.

An inflammatory condition involving the heart muscles; may be either acute or chronic. It occurs as *(a)* parenchymatous, *(b)* interstitial. Steffen has reported 33 cases. It is met with more often in boys than in girls.

This affection is very frequently seen during the convalescence of diphtheria. It is also a frequent complication of scarlet fever. I have met this complication in the wards of the Willard Parker and Riverside Hospitals.

Causes.—When it is primary it is due either to rheumatism, congenital syphilis, or tuberculosis. Secondary, it is due to endocarditis, pericarditis, toxins from infectious fevers, or phosphoric, arsenic, or lead poisoning. Traumatism has also caused myocarditis.

Pathology.—The heart muscles appear pale, soft, and friable. The whole heart is not always affected; certain portions may show evidences of degeneration and fatty infiltration, while another portion may be normal. The myocardium is very susceptible to the toxins of infectious diseases. *This is especially true when diphtheria and scarlet fever have existed prior to the heart lesions.*

Symptoms.—The pulse is very feeble and slow; in some cases irregular; in other cases regular. Sometimes the pulse rate is increased. The extremities are usually cold, the surface of the skin cool. In some cases there is a slight rise of temperature, 100° to 101° F. Other cases show a subnormal rectal temperature of 96° to 98° F. It is very evident that the toxins of the infectious diseases inhibit the proper action of the thermic centers. I have seen distinct vasomotor disturbances, such as unilateral flushing, affecting one cheek or the lobe of one ear. The child shows a marked general depression. There is a general devitalization noticeable; also markêd apathy. The child appears listless and prefers to rest.

The Heart.—There is an irregular, very rapid heart's action. The heart sounds are very indistinct. When the above symptoms occur during the course of infectious diseases, myocarditis should be suspected. Sometimes there is faintness, severe dyspnœa, and cyanosis. Not infrequently there is albumin in the urine. Dilatation and hypertrophy sometimes occur without showing distinct symptoms. The ratio of the pulse and respiration will be disarranged.

Diagnosis.—In some cases this is very difficult to make. The presence of a slow pulse and muffled heart sounds during the beginning or during the convalescence of acute infectious diseases, should always lead to the suspicion of myocarditis. A slow pulse in itself should always be looked upon as ominous.

Frequently a diagnosis of myocarditis is made at the autopsy when *no positive symptoms* of the condition *were present* during life.

Prognosis.—The prognosis is certainly not good. Rarely do we find cases of myocarditis recover. This is especially true when myocarditis complicates the acute infectious diseases and the child is in a devitalized condition.

Treatment.—Excitement or exertion may cause sudden death. The child requires absolute rest. It should be put to bed in a recumbent position. High saline injections at a temperature of 115° to 120° F., using several quarts of salt water, can be tried two or three times a day. The diffusible effect of the hot saline and consequently the tendency to eliminate toxins through the kidney, should serve as a valuable therapeutic adjunct. Life can certainly be prolonged by this measure; if it is cautiously done, so as not to exert the child's heart, the result will be apparent very soon.

Another diffusible stimulant which has served me very well is the injection of hot water to which several grains of carbonate of ammonia have been added. In some cases of severe cardiac depression I have seen good results from the injection of:—

℞ Sp. ammon. aromatic	$^{1}/_{2}$ drachm
Hot water	1 quart

Inject through a rectal tube into the colon, at a temperature of 110° to 115° F., once in six hours, alternating with the hot saline.

In syphilis or tuberculous conditions the treatment should be specific. When evidences of heart failure exist strychnine, caffein, whisky, aromatic spirits of ammonia, and nitroglycerine may be used. Spartein in small doses ($^{1}/_{10}$ grain every hour) may be given. The value of concentrated food is greater in this condition than in any other.

Feeding.—No drug will give as much strength to the body as food. Food should be given very frequently in small quantities. A cup of concentrated chicken broth or beef broth should be given, and two hours later the white of two or three raw eggs with sweetened coffee. Milk punch, cocoa, chocolate, or strained oatmeal gruel may be given. One of the above foods may be given every two hours. Several ounces may be given at each feeding. The outcome of the case depends upon strengthening the heart. My plan has been to give the strychnine in the food. Drugs have a more diffusible effect and seem to enter the circulation better when combined with hot food. If for any reason the stomach is sensitive and does not retain food, rectal feeding with peptonized milk may be necessary along with the hot salines previously mentioned.

CHAPTER III.

DISEASES OF THE LIVER.

THE LIVER.

THE liver in nurslings is relatively larger than in adults. To examine the liver place the child on its back with the legs slightly flexed toward the abdomen. Have the child, if possible, breathe with regularity.

Position of Liver.—Dullness can be made out from the fifth intercostal space in the mammary line to about one inch below the border of the ribs. In the axillary line it reaches from the seventh intercostal and posteriorly a dullness is made out at the ninth intercostal space. It extends downward and can best be made out by palpating.

Birch-Hirschfeld found the average weight of the liver in the new-born infant about four and one-half ounces (127 grams).

Steffen who has devoted considerable attention to the liver states that the left lobe is relatively larger in the child than in the adult.

BILE.

The quantity of bile in the gall-bladder is very small. It is of a golden-yellow color, and has a neutral reaction. Its specific gravity varies from 1014 to 1053. According to Baginsky the bile in nurslings contains organic salts—cholesterin and lecithin—fat, and various acids in less proportion than in adults. Baginsky was able to demonstrate the presence of glycocolic acid. The presence of a much less quantity of bile-acids in the infant is a beneficial physiological condition. It is a well-known fact that these acids inhibit the digestive action of the pepsin and of the pancreatic juice. Another point is that the absence of a bile-acid prevents the assimilation of large quantities of fat, as it is impossible to split up the fat into fatty acid and glycerine. Thus, fermentative processes are much more frequent in nurslings and appear with greater intensity than in the adult, because of the biliary acids. The amylacea and all substances containing flour are—owing to the above-described condition of the pancreatic juice and the bile—not fit substances to give the infant, especially during its first three months of life, *although very small quantities can be digested,* and after the fourth month are not only digested, but also absorbed.

Baginsky and Sommerfeld found large quantities of mucin in the bile.

JAUNDICE (ICTERUS).[1]

There are two forms of jaundice met with in children: first, hepatogenic; second, hæmatogenic. The most common form seen in children is a catarrhal jaundice. This is due to an extension of the catarrhal process from the stomach to the duodenum, causing catarrh of the bile ducts. (See chapter on "Gastro-duodenitis.") In the hepatogenic form, there is an obstruction to the flow of bile into the bowel. It is also called obstructive jaundice.

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[1] **Icterus neonatorum is described in Part II, "Diseases of the New Born."**

In the hæmatogenic form there is no obstruction to the flow of bile, but the jaundice is due to blood conditions. We find jaundice in sepsis, in malaria, and in typhoidal conditions. Mechanical obstructions, such as round worms entering the common duct, have been reported, but they are rarities.

ACUTE CONGESTION OF THE LIVER.

In literature very little light is shed on this condition. Some authors state that malaria and other poisons, particularly phosphorus, may cause this condition. I believe that acute congestion of the liver is frequently associated with acute gastric catarrh. It is also no doubt one of the factors on which intestinal indigestion hinges. The symptoms are mainly those of enlargement which can be made out by palpation and functional derangement such as will be considered in the next article.

FUNCTIONAL DISORDERS OF THE LIVER.

Functional Derangement.—This very common condition is characterized by either a total absence or a diminution in the quantity of bile secreted. This functional disorder usually causes very dry, grayish, or whitish "clay colored" stools; also flatulence. The urine is of a very dark reddish or brownish color. Frequently the skin and conjunctival mucous membrane is pigmented. The temperature may reach 101° F.; rarely higher than 103° F. If after rest, proper diet, and hepatic stimulation the fever persists, then the possibility of abscess in the gall-bladder should be remembered.

Treatment.—Calomel, podophyllin, or elaterin in small doses. The salines and phosphate of soda in 5 or 10-grain doses can be given. Diluted hydrochloric acid or diluted nitro-muriatic acid, in 1-drop doses, is a good bile stimulant. In some cases a gentle faradic current and massage may do good. A cold spray over the liver will also tone the same. Large quantities of liquids will sometimes aid in relieving functional disturbance of the liver.

DISPLACEMENT OF THE LIVER.

The liver may be displaced downward when the ribs are contracted in size. This condition is best noted in rickets. The liver may also be displaced by pleural effusions. It is found much lower in diseases wherein emaciation takes place, such as in marasmic or tubercular manifestations. In these latter conditions relaxation of the abdominal walls permits the liver to occupy a position much lower than normal.

Displacement Due to Diseases of the Adjacent Organs.—The liver is sometimes displaced by tumors arising in the right pelvic region, chiefly from swelling associated with the right kidney. In a case of mine (see chapter on "Pyelitis") the kidney pushed the liver upward and to the left. The liver returned to its normal position after the diseased kidney was removed.

Several years ago, at the Kaiser and Kaiserin Friedrich Children's Hospital of Berlin, I saw a case of a child having a supposed tumor involving the liver. While all believed that the swelling was associated with the liver, after the abdomen was opened it was found that the kidney was the seat of the trouble and that the liver was unaffected.

DESCENDED LIVER.

Rowland G. Freeman, in studying a series of 496 autopsies in children, states that he has met, not very rarely, with descended liver. These enlarged livers were found in children suffering with tuberculosis and lobar pneumonia. In his cases the liver had slipped down the right side of the abdomen.

AMYLOID DEGENERATION (WAXY LIVER).

This is an extremely rare condition. Freeman mentions but two cases in his large post-mortem experience, one case associated with tuberculous disease of the vertebræ and psoas abscess, and the other case in a child suffering from progressive anæmia. The liver and kidneys were waxy in both cases.

Experimentally, amyloid degeneration has been produced by the action of the toxins of the staphylococcus pyogenes aureus.

Symptoms.—Special symptoms which could be called those specifically due to this condition cannot be described. The symptoms of the disease associated with amyloid degeneration are present on palpation. The liver is enlarged, the surface very smooth and hard, without tenderness. The spleen is also enlarged. Dropsy is usually present. The latter symptom must not necessarily be due to the kidney, but may result from pressure of the swollen liver upon the vena cava. When this disease is associated with syphilis then symptoms of the latter disease may also be found.

The prognosis is usually bad.

Treatment.—This depends on the symptoms which require urgent management. Syphilis when present requires anti-syphilitic treatment. The outcome of the case depends on restorative treatment, including nutrition.

FATTY LIVER.

Fatty degeneration of the liver is very frequently noted in children. Wollstein has found 201 cases of fatty liver in 345 consecutive autopsies. Freeman and Long studied a series of 296 autopsies at the Foundling Hospital, and found 202, or about 68 per cent., fatty livers. This disease is not as frequently found associated with wasting diseases as is claimed.

The following classification of causes or conditions with which fatty liver is associated is given by C. Oddo, in *Grancher's Maladie de l'Enfance*:—

1. Intoxications: Phosphorus, alcohol.

2. *(a)* Infections, acute: typhoid fever, measles, scarlet fever, smallpox, and diphtheria, bronchopneumonia, acute general tuberculosis, and diarrhœa. *(b)* Infections, chronic: chronic tuberculosis, hereditary syphilis.

3. Maladies of nutrition: chronic gastro-enteritis, rachitis.

4. Fatty liver associated with the hepatic lesions.

Cirrhosis of the Liver (Interstitial Hepatitis).

Two varieties of cirrhotic liver are seen in children; they are: *(a)* atrophic, *(b)* hypertrophic. This condition is caused by the same factors that produce cirrhosis in the adult. The two most important factors that produce this condition are syphilis and the excessive use of alcohol. Freeman reports two cases in neither of which alcohol was the cause of the condition, nor was any acute disease reported prior to the cirrhosis.

Symptoms.—Digestive disturbances, such as fullness in the abdomen, constipation, or diarrhœa exist. The temperature is irregular. As a rule the liver is not enlarged.

Diagnosis.—This is sometimes extremely difficult and can only be determined positively by a post-mortem.

Prognosis.—The prognosis depends on the cause. If due to syphilis, the prognosis is fair; if due to alcohol, then it is grave.

Treatment.—The treatment of the case depends on the symptoms presented.

Focal Necrosis.

This is usually found associated with infectious diseases. It has been observed resulting from the toxin of diphtheria and measles. Freeman found focal necrosis in 4 cases out of 14 consecutive autopsies on measles cases.

Summary.—"1. Descent of the liver down the right side of the abdomen, so that the right lobe reaches below the crest of the ilium, occurs occasionally in infants, and particularly in those in whom the liver is enlarged.

"2. Fatty livers occur very frequently in the infants and children who die at the New York Foundling Hospital, or in about 41 per cent. of all cases.

"3. The condition of nutrition of the child, as expressed by the absence of fat in general and wasting of tissue, apparently has no connection with the fatty condition of the liver, the condition of nutrition in the cases having fatty livers averaging about the same as in the whole number of cases.

"4. Fatty livers occur rarely in the following chronic wasting diseases: marasmus, malnutrition, rachitis, and syphilis, unless such condition be complicated by an acute disease.

"5. With tuberculosis fatty livers occur not more often than with other conditions.

"6. Fatty livers occur most often with the acute infectious diseases and gastro-intestinal disorders.

"7. The two cases of cirrhosis of the liver examined by the writer ran a comparatively acute course. The livers on section showed a marked hyperplasia of the so-called new-formed bile ducts.

"8. Focal necrosis of the liver may be a lesion of measles."

Read articles on "Liver," "Bile," and "Congenital Obliteration of the Bile Ducts" in the chapter on "The New-born Baby."

SUBPHRENIC ABSCESS.

This condition is very rare in children. It consists of an accumulation of pus *above the liver, but beneath the diaphragm.* Carl Beck has described this condition *in extenso* in a paper read before the New York Academy of Medicine several years ago.

Meltzer[1] reports a case occurring in a child 2 years old.

Jopson[2] has recently reported a case from the Children's Hospital, in Philadelphia.

Maydl[3] has studied a series of 179 cases. Of these cases which were found in all ages, 10, or 5.9 per cent., were under 15 years of age. The causes in Maydl's cases were attributed to the stomach and duodenum, intestinal, pericæcal (including appendicitis), echinococcus, subcutaneous traumatism, cholangitis, perinephritis, metastatic wounds and gunshot injuries, and caries of the ribs.

Jopson, in reporting the causes of 12 of his cases, includes appendicitis, perforated gastric or duodenal ulcer, caries of the dorsal vertebræ, traumatism, and calculous cholecystitis.

In a case reported by A. Frederici[4] a girl, 8 years old, had an abscess which ruptured into the lung. The diagnosis of subphrenic abscess, secondary to liver abscess, was founded on tenderness over the liver region before the abscess ruptured, and on the absence of air in the abscess cavity.

Baginsky reported a case in a child, 2 1/2 years old, secondary to appendicitis.

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[1] New York Medical Journal, June 24, 1893.

[2] Archives of Pediatrics, February, 1904.

[3] Subphrenic Abscess," Wien, 1894.

[4] In Monatschr. f. Kinderheilk, July, 1903.

CHAPTER IV.

DISEASES OF THE SPLEEN AND PANCREAS.

THE SPLEEN.

ONE of the most difficult organs of a child to examine is the spleen. It can be palpated between the ninth and eleventh ribs. It is impossible to positively outline the spleen by percussion. For the purpose of examination the child should be placed flat on its back with the thighs flexed. By gentle manipulation with the tips of the fingers, we can frequently in a quiet child press under the free border of the ribs and feel the smooth border of the spleen. *Some authors maintain that when the spleen is palpable, it is enlarged.* I have frequently been able to palpate the spleen in perfectly normal infants.

There are no primary diseases of the spleen, although it is frequently the seat of tubercular disease.

ENLARGEMENT OF THE SPLEEN (SPLENITIS).

An enlarged spleen is frequently seen in various systemic conditions. It is one of the characteristic symptoms of many of the acute infectious diseases. It is a prominent symptom of malarial infection and typhoid fever, and next to the condition of the blood itself, is a very valuable aid in the diagnosis. In cachectic conditions and in such constitutional disorders affecting the blood, as, for example, in rickets, a very large spleen can frequently be palpated. An enlargement of the spleen reaching into the groin was seen by me in a case of rickets. The spleen, therefore, is a very valuable aid to diagnosis in many conditions. For a description of the method of examination see article on the "Spleen in the New-born Baby."

WANDERING SPLEEN (MOVABLE SPLEEN, LIEN MOBILIS).

When there is an elongation of the gastro-lienal ligament, the spleen can be readily moved.

Causes.—Severe paroxysms of coughing, such as whooping-cough or traumatism, can cause this condition.

Symptoms.—In young children there are no special guides. Older children complain of pain on the left side and vague abdominal pains.

Diagnosis.—The diagnosis is made by palpating the wandering spleen.

Treatment.—An abdominal bandage to support the abdomen will frequently aid in replacing the spleen. Rarely will surgical treatment be demanded.

THE PANCREAS.

The pancreas is situated behind the stomach. It is about the height of the first lumbar vertebræ. The function of the pancreas is known as the *amylolytic function,* namely, starch digestion, in reality the conversion of starch into sugar.

DISEASES OF THE PANCREAS.

Syphilitic tissue changes are frequently seen in the pancreas. Malignant tumors are occasionally reported in the literature. When such lesions exist they tax the diagnostic skill of the specialist. The diagnosis is rarely made *intra vitam.*

CHAPTER V.

DISEASES OF THE PERITONEUM.

ACUTE PERITONITIS.

THIS is a very rare condition in childhood. It is most frequently seen in practice in the new-born, where the inflammation is the result of a pyogenic infection through the umbilical vessels. This has been described in the chapter on the "New-born Baby."

Etiology.—This inflammation is frequently the result of traumatism. It may follow the operation for appendicitis or other operation on the abdomen. Cases have been reported where an infection such as gonorrhœa or vulvo-vaginitis has extended into the uterus or into the peritoneum. This condition may frequently accompany Pott's disease or perinephritis, and may also follow deep-seated burns in which cellulitis or erysipelatous inflammation exists.

I have seen peritonitis as a complication of scarlet fever in hospital and private practice.

Bacteriology.—The streptococcus is most frequently found to be the cause of peritonitis in the new-born. Sometimes the pneumococcus and the bacterium coli communi are found.

Pathology.—*Serous Form:* There is a large outpouring of serum which is clear, and there is a small amount of lymph associated with it. When recovery takes place the serum is absorbed. Adhesions usually follow.

Fibrinous Form.—The peritoneum is intensely congested. The blood-vessels injected and a large amount of lymph is thrown out with very little serum. The pathological process corresponds to that condition seen in fibrinous pleurisy. Firm adhesions resulting in the formation of connective tissue bands usually remain.

Purulent Form.—A large amount of lymph and pus are present with the usual evidences of inflammation. The abscess is rarely localized or isolated from the rest of the peritoneum by a thick wall of fibrin. Spontaneous evacuation of pus through the vagina, rectum, bladder, or umbilicus has been reported. Such cases may recover. As a rule purulent peritonitis is fatal.

Symptoms.—The symptoms of fever, vomiting with pain, and uniform distention of the abdomen, are usually present. There is also tympanites, and when liquid is present fluctuation can be felt. The child is usually found flat on its back with the legs flexed. Diarrhœa exists in some cases, constipation in others. The child appears very sick and suffers continuous pain. The following case occurred in my practice:—

Jessie M., 2 years old, had typical symptoms of influenza. There was coryza, sneezing, and a temperature of 104° F. At this time there had been a house epidemic and all members of the family were suffering with influenza. The child had anorexia and vomiting, and cried continuously as if in pain. The abdomen was distended, and constipation reported. A soap water enema was ordered, and although a good result followed, the crying continued. The abdomen was tympanitic on percussion and the uniform distention continued. An ice-bag was ordered, but gave no relief. Local applications of warm *antiphlogistine poultices* seemed to afford relief. Chamomile injections at a temperature of 115° F. were ordered given into the colon. When the same passed off another injection of 8 ounces of warm olive oil not only relieved the child but produced sleep. These injections were repeated three times a day. Codeine with calcined magnesia was ordered to relieve pain and for the antifermentative effect.

Feeding.—Whey was given every four hours and several teaspoons of Mulford's predigested beef with whisky every two hours. The disease lasted about two weeks. The child recovered.

Prognosis.—This disease is frequently fatal, especially the purulent variety. The most favorable cases are those in which there is a sero-fibrinous exudation. The outcome depends on the vitality at the time of illness.

Treatment.—Warm applications have served me best, although some authors, especially the Germans, prefer ice. Hot moist flannels, to which 15 to 30 drops of turpentine have been added, will usually relieve tympanites. Codeine should be given until the child is comfortable, $^1/_{10}$ to $^1/_5$ grain, every two hours or oftener. My results have been best when milk was omitted. Soup or broth may be given. Whey is valuable in this condition, also white of raw egg well beaten with sweetened water. The treatment described in the clinical case above cited is my usual method adopted. The high colon flushings are cleansing and soothing. When great prostration exists, instead of using chamomile tea and warm olive-oil, normal saline solution has a more toning effect. Special symptoms, such as collapse, require strychnine, nitro-glycerine, or caffeine sodium benzoate. Also liberal stimulation with champagne or whisky. Oxygen if cyanosis exists.

Operative Treatment.—If symptoms of appendicitis exist, then an operation may do good. If a sudden collapse is noted perforation should be suspected and the surgeon consulted at once.

CHRONIC PERITONITIS (NON-TUBERCULOUS).

Many authors doubt the existence of a non-tuberculous peritonitis. Henoch believes that we have a distinct variety of chronic peritonitis which bears no relation to tuberculosis.

Symptoms.—In a distended abdomen associated with ascites the liquid can be made out by palpation. There may be diarrhœa or there may be constipation. Dyspeptic symptoms are always present, and there is a slight rise of temperature. There are no other symptoms of tuberculosis, and as a rule no other complications present. Anæmia is usually very marked.

A child 8 years old was seen by me during my service in the German Poliklinik. He was a bottle-fed and rachitic boy. He had *suffered with a very severe acute milk infection,* resulting in *cholera infantum* and *peritonitis.* The child developed symptoms of athrepsia infantum. Several years later the child had a swollen tympanitic abdomen and a wave of fluid could be made out by careful palpation. I aspirated about 1 pint of a yellow serous fluid. The same was examined and no tubercle bacilli or other bacteria were found. The condition improved. The case was seen by me twice a month and it was necessary to tap the abdomen each time to relieve distention. The child was under observation about six years. During this time large doses of iodide of sodium, codliver-oil, and iron were ordered. A change to the country seemed to do the most good. The child is well to-day.

TUBERCULOUS PERITONITIS.

The peritoneum frequently participates in a general tuberculous condition. It may, however, be an entirely independent disease; that is, it may occur as the primary lesion of tuberculosis. Biedert[1] collected a series of 883 autopsies on tuberculous children of various ages. He found the peritoneum affected in 18 per cent. The disease may be either acute or chronic.

Pathology.—In tubercular peritonitis the lesions are those of a general miliary tuberculosis. There are usually not very many tubercles scattered through the peritoneum. When the ascites is present then the tubercles are far more abundant. The omentum and mesentery participate in the tuberculous process. The liquid present may be brownish colored serum containing blood; it may be serous, or yellowish and contain pus.

The fibrous form usually shows adhesions between the loops of intestine or between the intestine and the abdominal wall. In the ulcerative form there is usually a fibrinous exudation. This form usually follows the miliary or fibrous variety.

Symptoms.—Well-marked evidences of peritonitis can usually be made out, when ascites and tympanites are present. When fever is associated with it in addition to evidence of cough or other physical signs in the lungs, then the diagnosis is not doubtful. Sometimes the tubercular or non-tubercular forms of chronic peritonitis will render the diagnosis very difficult.

Differential Points.—Cirrhosis of the liver may cause an ascites. It is rare in very young children. If the history of syphilis is given the same may be suspected. In some cases a diagnosis can only be made when an exploratory puncture is made and the fluid examined. Even then the diagnosis may be difficult. The only method then left is to make a microscopical examination of the fibrous nodules or rarely by inoculation experiments. The following cases represent tubercular peritonitis as occurring in my private practice:—

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[1] Jahrbuch für Kinderheilkunde, xxi, p. 178.

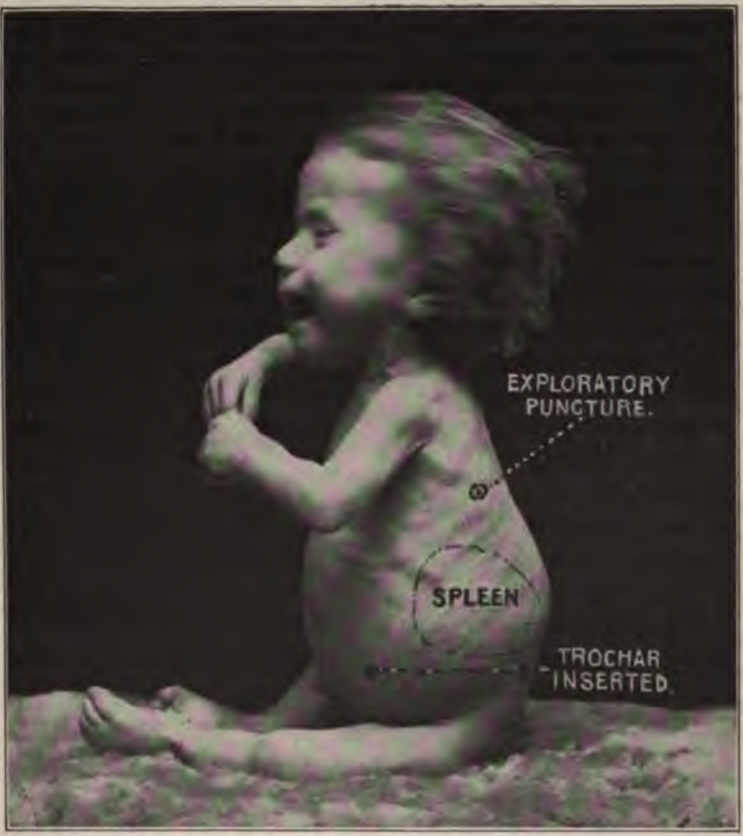

Fig. 118.—Case of Tubercular Peritonitis Complicated by Tubercular Empyæma. Enlarged Spleen. Rachitic Bottle-fed Infant. (Original.)

M. B., female, 2 years old, was brought to me with a history of cough, distended abdomen, and severe constipation alternating with diarrhœa. The appetite was poor, and the child had lost considerable in weight and has not been well since an attack of measles which occurred about one year ago. Evidences of tuberculosis were made out. The stool contained mucus. Tubercle bacilli were frequently found in the mucous discharges. A cavity could be made out at the left apex. The child suffered with recurring pleurisy. The chest contained a large quantity of liquid effusion for over four months. Nine ounces of a thin greenish fluid was aspirated from the left side of the thorax. Examination showed tubercle bacilli and also streptococci. The abdomen was enormously distended and a wave or distinct thrill of liquid could be felt by transmitted palpation. Extreme dyspnœa was caused by the pressure of this liquid on the diaphragm. By aspiration I removed 1000 cubic centimeters of a yellowish serous liquid from the abdominal cavity. Temporary relief was afforded, although the abdomen refilled very rapidly. It was necessary to tap the same once every six weeks. The child finally died of exhaustion. (See Fig. 118.)

A second case occurred in a little girl, Katie B., about 9 years old who was under the treatment of Dr. John H. Wurthman. The same symptoms as I have described in the previous case were found, general tuberculosis with especial pulmonary manifestations and symptoms of peritonitis. In this case I aspirated over three pints of liquid from the abdominal cavity. The child gradually sank and died several months later.

Prognosis.—When ascites is present the prognosis is not good, especially if operative measures are undertaken. As a rule cases end fatally.

Treatment.—For a number of years laparotomy was advised as the best method of treating tubercular peritonitis. Many successful cases were reported. It was believed that after the abdomen was opened, drained, and sunlight admitted, that this latter agent aided the healing process. In recent years many pediatricians hold the opposite view.

Light Treatment.—Not very long ago I saw a case of tubercular peritonitis (non-operative) which was progressing very nicely. It was under the treatment of direct sun rays, besides receiving an electric light bath for ten minutes each day. The influence of light has in recent years demonstrated its value, especially in tubercular manifestations.

A very interesting monograph on this subject has been published by Aldibert, of Paris, 1892. Baginsky extols the value of operative procedures in tubercular peritonitis. The reader is referred to modern works on surgery for exhaustive data on this subject.

The general treatment consists in restoratives, building up the body by nutrition, and by tonics when possible.

Serum Treatment.—The use of streptolytic serum in doses of 10 to 30 cubic centimeters is well worth trying. Antistreptococcus serum (10 to 50 cubic centimeters) can be injected in daily doses of 10 cubic centimeters, or the dose may be given every two or three days.

ASCITES.

This is an accumulation of clear serum in the peritoneal cavity. When it is very severe there is, in addition to the uniform distention of the abdomen, a superficial enlargement of the veins. This is especially noted around the veins of the umbilicus.

Causes. — Pressure upon the vena cava, or chronic heart or lung trouble, such as pleurisy, may give rise to ascites. In extreme leukæmia, anæmia, or kidney disease ascites may be present.

Diagnosis.—The fluid can best be made out by tapping the abdomen and noting the transmission of the wave. On tapping the abdomen with one hand and pressing the other firmly against the opposite side, a wave of fluctuation can be made out.

The *symptoms, prognosis,* and *treatment* will be considered in the article on "Ascites Due to Peritonitis."

ASCITES DUE TO PERITONITIS.

In the majority of cases ascites is caused by tubercular peritonitis. This condition resembles in its clinical and pathological aspects subacute or chronic pleurisy with effusion, or subacute pericarditis.

Etiology.—No definite cause and no specific agent has yet been determined. Most of the cases are associated with or follow rheumatism, measles, or exposure to cold, and in rare instances injury to the affected parts. It is also seen associated with diseases of the kidney, liver, and intestines.

Pathology.—The pathological lesions are very few. The effusion is usually of a greenish color. In addition to the serum there is fibrin, and in some instances adhesions. In some cases all the serous membranes of the body seem to participate and show evidences of inflammatory condition.

Symptoms.—The early symptoms of ascites consist of general malaise. A child will have a poor appetite, complain of headache, and sometimes constipation. In other cases diarrhœa may exist. Pain is not present as a rule. The abdominal distention comes on gradually and progresses. The distention is usually the first symptom noted by the mother. The fluid can best be made out by tapping the abdomen as described in the foregoing article on "Ascites." Fever is usually absent, although there may be an evening temperature of 101° F.

Prognosis.—The prognosis is fair as a rule. I have seen many cases of ascites recover, leaving no trace of the former trouble behind. A cautious prognosis is advised if a tuberculous process is suspected.

Treatment.—*General Treatment:* Such children must be put to bed. The diet should consist of concentrated liquid food. No solid meats should be permitted. Milk, if not well borne, should be peptonized or fermented. Buttermilk may be recommended. Fresh air and sponge bathing should be remembered as important hygienic factors.

The body should be well protected to avoid chilling the surface.

Treatment of the Effusion.—Small doses of calomel or podophyllin may be given until liquid stools are produced. Diuretics such as cream of tartar, lemonade, or diuretin, in 5-grain doses, will stimulate the action of the kidneys and thus lessen indirectly the serous effusion in the abdomen.

Iodide of sodium in 3 to 10-grain doses should be given three times a day to promote absorption. It may be combined with iron in the following manner:—

℞ Ferri et kali tartaric	1 drachm
Sodium iodide	1 drachm
Elix.of lactopeptin, q. s. ad	2 ounces

Sig.: One teaspoonful three times a day.

Tapping the Abdomen.—Aspirating the liquid by means of a trochar and cannula is a valuable means of emptying the liquid. It is especially indicated if symptoms of dyspnœa due to pressure on the diaphragm are noted.

If relapse occurs and the liquid continues to accumulate after several aspirations, then surgical treatment will be necessary. The occasional good results seen in tubercular peritonitis after a laparotomy should be remembered.

CHAPTER VI.

DISEASES OF THE GENITAL ORGANS.

HERNIA.[1]

HERNIA is occasionally seen in the new-born baby. It is overlooked in a good many cases until the size of the tumor indicates that something is abnormal, as there are no special symptoms (see article on "Hygiene of the Infant" in the "New-born Infant").

"In congenital hernia proper, anatomical conditions favorable to visceral escape always tend to permanent spontaneous cure in infancy and early childhood. At birth the spermatic vessels are deeply covered by a thick layer of adipose tissue. The dartos and cremaster are then highly developed, giving the scrotum dimensions quite out of proportion in size to what they are in adult life. Serous cysts of the tunica spermatica and of the tunica vaginalis being very common, this condition also with the scrotum fullness may simulate hernia so closely that it is only by a most painstaking examination we are enabled to exclude them. On the other hand, a small fringe of omentum may come down with the cord and be completely overlooked."

Thomas H. Manley, in his monograph on "Hernia and its Treatment," says: "The prevalent custom of applying a band or binder around the abdomen should be condemned. It conserves no useful purpose; the only excuse for it at all is that it retains the envelopes of the funis in position. If this firm, inelastic compression does not in many cases directly cause hernia in those predisposed to it, I am confident it often very seriously interferes with spontaneous cure, by the increasing pressure which it produces against the abdominal walls. In the herniated infant this, then, should be cast aside, the dressing for the navel string being held in position by adhesive straps or tapes passed around the body. After the desiccated remnant of the cord has dropped off nothing whatever in the way of a girth should be worn around the abdomen, but the garments, when the erect attitude is taken, should be all carried from the shoulders, thereby the feeblest possible action being given to the diaphragm and the organs of digestion. Occasionally we see one side of the scrotum occupied by a hernia before the testicle has descended. Congenital hernia is very rare in females. In the female the umbilical hernia is more common."

Causes.—A calculus in any portion of the urethra or a phimosis or atresia of the urethral canal may cause powerful contractions of the ab-

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[1] For Umbilical Hernia see chapter on "Diseases of the Intestines."

dominal muscles, resulting in a hernia. Coughing, especially whooping-cough, frequently produces hernia. Constant straining efforts during constipation or when diarrhœa persists frequently end in hernia.

Symptoms.—In male infants a tumor that is soft and round will be found in the scrotum. The testicle, although at times difficult to feel, is usually felt above or behind the swelling. This swelling consists of a loop of intestine, rarely the peritoneum descends with it. By placing the child on its back the swelling can easily be pushed into the abdomen through the abdominal ring. There is always a gurgling sound which is characteristic of hernia.

Diagnosis.—Hernia is frequently mistaken for hydrocele. Both hydrocele and hernia are sometimes found in the same case. The following differential points are well worth noting:—

TABLE No. 59.

Hydrocele.	*Hernia*
1. Translucent by transmitted light.	1. Is opaque.
2. Always dull on percussion.	2. Always resonant.
3. When reduction is possible the fluid passes back slowly and noiselessly.	3. The hernia passes back quickly and gives the characteristic gurgling sound.
4. No impulse on coughing.	4. An impulse can be felt when patient coughs.
5. The ring is empty.	5. The ring is filled with the neck of the tumor.

Prognosis.—This is usually good. Children rarely have strangulation as we find it in adults. Most of the cases of hernia seen by me in children, recovered with the aid of a properly fitting truss. At times nothing but an operation will cure the case.

Treatment.—The diet should be regulated. If any apparent cause exists, such as prolonged diarrhœas with tenesmus, constipation, or cough, the same should be treated. If a whooping-cough exists the proper treatment must be instituted before mechanical appliance is ordered. This consists chiefly in relieving the hernia with a truss. My own experience has been rather good by having a rubber sponge with a rough surface made to include the hernia. This should be held in place by the usual strap going around the body. The leather covered, or the celluloid front pads are continually slipping; hence, not so well adapted for children. The hygiene should be well considered in a child. A truss on a diapered infant is a nuisance, it cannot be kept clean; hence every nurse or mother should be instructed regarding the sensitive skin and the danger of causing irritation from moisture. Every mother should be taught to watch the infant when it cries or strains to prevent the truss from slipping.

Surgical Treatment.—With modern aseptic methods there is little or no risk in an operation. The success of the Bassini operation is so uniform that I have seen dozens of children operated with no fatalities. For the details of this surgical method I would refer the reader to textbooks on surgery.

HYDROCELE.

"The testicle in its descent is surrounded by a serous membrane described by some authors as a serous pouch. When this pouch fills with serum it is called a hydrocele. Normally a few drops of serum are found in the tunica vaginalis propria. Larger accumulations are met with in more than 10 per cent. of male infants, mostly on the right side, seldom on both. In the majority of cases there is no longer a communication with the abdominal cavity. When it remains a hernia may complicate the hydrocele and the diagnosis be more difficult, because the fluid is apt to return occasionally into the abdomen. Spontaneous absorption is not very rare, but suppuration is uncommon."

Treatment.—Under aseptic precautions a sterilized needle or trocar should be introduced. By this means the serum can be removed. This simple method has frequently resulted in a cure. When the hydrocele fills up again the injection of a few drops of tincture of iodine or Lugol's solution, or pure carbolic acid after the serum has been withdrawn, will usually prove successful. Operations are rarely required, although they are indicated if this milder form of treatment proves unsuccessful.

ADHERENT PREPUCE.

Congenital agglutination of the prepuce and the glans penis is occasionally reported. The majority of cases seen are *acquired* conditions. Smegma frequently collects under the foreskin when the same is not properly cleaned.

Treatment.—With a blunt probe an adherent prepuce can be loosened from the glans penis. The smegma should be removed and the parts lubricated with albolene or olive-oil. The mother or nurse should be instructed to oil these parts and thoroughly separate the prepuce so that new adhesions do not form. If this trouble recurs then circumcision is indicated.

PHIMOSIS.

Phimosis is due to a narrowing or contraction of the prepuce so that the foreskin is prevented from being drawn back over the glans penis. A tight prepuce or an elongated prepuce is a constant source of irritation. Bed wetting is a very frequent symptom of this condition. There is an itching and an irritation which frequently leads to bad habits. The sensitive condition sometimes causes priapism, and this may lead to masturbation. Night terrors and insomnia are frequently caused by this condition. Phimosis is sometimes an exciting cause of chorea and various nervous diseases.

Symptoms.—Such children invariably suffer with anæmia. They are peevish and restless and constantly irritable. The main symptoms are a series of irritations caused by the tight foreskin as outlined above. In exceptional instances strong healthy children may not show any symptoms of this condition.

The following case was seen by me in private practice:—

A boy, 4 years old, has always been in apparently good health. He was breast-fed, well-nourished, and showed no evidence of rickets. His mother complained to me that the child had a "weak bladder," that he could not hold his urine, especially at night. He was restless and peevish, and tossed about in his sleep. On examination I found a phimosis existed. The prepuce did not slip over the glans and the child cried as though in pain whenever the genitals were touched. I advised stretching the foreskin and this was done every few days with some degree of success, for the period of about three months. The child improved. When seen again about one year later the symptoms of nervousness, and restlessness reappeared. I then advised circumcision. With the assistance of Dr. John H. Wurthman, who administered chloroform, the prepuce was removed, the parts were dusted with europhen and the wound healed *per primam*. The child improved gradually and is a good healthy child to-day.

Treatment.—The treatment outlined in the case above described is the only one that should be used: First, stretching the prepuce, and secondly, if this does not afford relief, circumcision.

Operation.—A simple method is to make an incision or cut the dorsum of the prepuce with a scissors. After this incision is made we invariably have another skin to divide which is the mucous membrane. Unless this is also incised we cannot expect relief from the constriction. As a rule small, cheese-like particles, called smegma, will be found which must be cleaned away. Then follows the surgical treatment, such as checking hæmorrhage, if the same is profuse. In rare cases one or more stitches may be necessary to control the bleeding. I invariably use a piece of sterile gauze saturated with Monsel's solution immediately after the operation, then dust the parts with europhen. Great care should be used to avoid infection from a case of diphtheria or erysipelas. It is safer to have a surgeon supervise or perform the operation than to run the risk of infection.

PARAPHIMOSIS.

This is a condition caused by the swelling of the glans or by an abnormally small preputial orifice.

Treatment.—Have the thumb and finger of one hand pressing on the glans, with the other hand an attempt should be made to draw the prepuce back in position. In some cases immersing the parts in very warm water for several minutes has served me very well. If the parts are very tender a spray of ethyl chloride can be used with advantage before the attempted reduction. When the parts are very œdematous then puncturing the surface to relieve the serum will sometimes yield good results. At times surgical relief may be demanded.

Hypospadias.

The urethra sometimes opens on the under side of the penis. This is always a congenital condition.

A case of this kind was seen by me in consultation with Dr. Julius Brandeis, of New York City. When I saw this infant it was three days old and apparently suffering pain. The bladder was distended and the infant had not urinated, according to the history given, since it was born. An examination showed a hypospadias. The urethral orifice in the glans penis was absent. With the aid of diuretics and a warm hip bath the infant urinated. I have seen this child many times since. He is now able to walk and talk and suffers no inconvenience.

The treatment is radical—by means of plastic surgery.

Epispadias.

In this condition the opening of the urethra is on the superior surface of the penis. It is less frequently met with than hypospadias.

The **treatment** is distinctly surgical and requires a plastic operation.

Cryptorchidism (Undescended Testicle).

The testes usually descend into the scrotum during the ninth month of pregnancy. In some children the testicles may remain in the inguinal canal or even in the abdomen.

Ralph C. was referred to me by Dr. W. Freudenthal. He was a well-nourished, healthy child. Was breast-fed and in apparent good health until two years ago. He suffered with cough, was a mouth breather, and snored at night, for the relief of which Dr. Freudenthal removed his adenoids. The child was brought to me for the relief of an irritable and restless condition. His mother stated that he scratched his nose and appeared to have a pruritis of the anus. The diagnosis of ascarides lumbricoides was made. While examining the child I found one testicle could be palpated in the scrotum and the other in the inguinal canal. By pressure on the abdomen it would descend. There were no symptoms directly attributable to this condition.

Treatment.—If no irritation is caused then let it alone. If a false passage has been made which gives rise to pain, then the question of removal of the testicle may come up. The case then is distinctly surgical.

ORCHITIS.

An inflammation of the testicle is a rare condition in infancy. Cases have been reported where injury caused orchitis. In the article on "Mumps" orchitis is mentioned as a complication. The treatment consists in rest and ice-cold applications of lead and opium. Laxatives are indicated to open the bowels and thus help relieve the inflammation.

URETHRITIS: VULVO-VAGINITIS.

Vulvo-vaginitis is a catarrhal infectious disease involving the female genital tract. It is divided into:—

(*a*) Simple or Catarrhal; (*b*) Gonorrhœal.

SIMPLE VAGINITIS.

The normal urethra of both male and female children, also the vagina, frequently has a simple catarrh. The symptoms noticed are those of swelling, inflammation and a catarrhal secretion.

Etiology and Bacteriology.—Normally the vagina contains a white diplococcus which is not decolorized by Gram.

In simple catarrhal vulvo-vaginitis we have a white diplococcus which also is not decolorized by Gram.

In gonorrhœal vulvo-vaginitis we have a white diplococcus which does not decolorize by Gram, and in addition thereto a yellow diplococcus called D. Flavus (Bumm).

These germs are usually found in conjunction with other micro-organisms or with streptococci. They easily stain with a watery solution of eosin and counterstain with an alkaline aqueous methylene blue solution.

The microscopical examination shows leucocytes, epithelium, and various micro-organisms; never gonococci.

Symptoms.—The parts are usually sensitive to pressure.

Children who are old enough complain of pain on urination, and also urinate very frequently. In very young children it is impossible, in fact, unnecessary, to make a vaginal or uterine examination.

This disease may last for months, especially so if the body is in a subnormal condition.

This simple catarrh affecting the vulvo-vagina is highly contagious, hence each case should be strictly isolated.

Children so afflicted should sleep alone.

GONORRHŒAL VAGINITIS.

Gonorrhœal vulvo-vaginitis is frequently met with in practice. As a rule it occurs among poorer classes where families are crowded and unsanitary. Frequently the infection is transmitted from the adult to the child by sleeping in an infected bed. Cases are on record where a mother suffering with gonorrhœal vulvo-vaginitis has infected her child while sleeping with it.

Etiology.—The slightest abrasion of the skin will permit the entrance of the gonococcus. Cases have been reported in which a healthy person was infected by taking a bath in the same tub in which a person affected with gonorrhœa had bathed the day previous. It is a well-known fact that the gonococcus will live twenty-four hours, hence these germs will persist in the tub and can transmit infection. For this reason a separate tub should be procured while gonorrhœal disease exists.

Bacteriology.—Gonorrhœal vaginitis is caused by the presence of the gonococcus. It is necessary, however, to subject the gonococcus described by Neisser to the Gram method of staining. The diplococcus found in the normal urethra can easily be differentiated by subjecting the same to the Gram stain. Normally the gonococcus has never been found in the vulvo-vaginal tract or in the normal urethra. The gonococcus can easily be stained with a 2 per cent. alcoholic methylene blue solution.

Mode of Infection.—Direct transmission of infected matter from adults to children has been known to occur. Infected clothing, especially bed linen, has transmitted this disease.

In rare instances the infection has taken place directly during the sexual act. There is a popular superstition that when an adult male has gonorrhœa he will be cured by raping a healthy child. An instance of this kind has occurred in my practice.

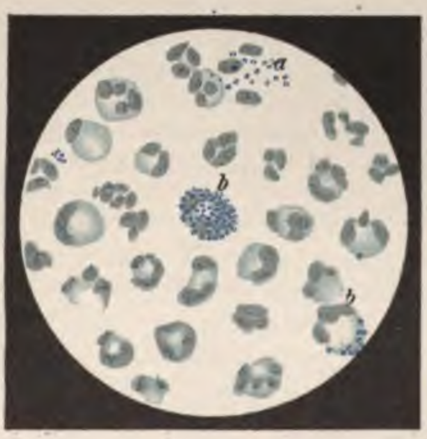

Fig. 119.—Gonococcus. (Gonorrhœal Pus.) Stained one-half minute with methylene-blue. *a*, Free in groups. *b*, Enclosed in pus cells. Leitz ocular I. Oil imersion $^1/_{12}$. (Lenhartz-Brooks.)

A little girl, 6 years old, apparently healthy, was infected by an adult suffering with gonorrhœa. She suffered continuously for over four months until brought to me, when her vulva, vagina, and urethra were one mass of inflammation. There was a greenish yellow discharge. The bacteriological examination showed diplococci in the leucocytes.

The child was put to bed and a sterilized pad applied over the genitals. This pad was changed every four hours. A sitz bath of 1 to 2000 warm bichloride was ordered morning and evening, lasting twenty minutes. A vaginal injection of 5 per cent. argyrol solution was given immediately after each bath. Internally iron was given. The discharge continued eleven days and everything seemed well. A reinfection evidently took place four days after having stopped the active treatment, as the discharge appeared with renewed vigor. The child was again carefully treated with astringents. The discharge persisted for three months, when it was finally cured.

Complications.—*The Eye:* The danger of transmitting gonorrhœal infection by the hands from the genitals to the eyes must always be remembered. That this form of infection is not without danger is well known. At the Riverside Hospital in the scarlet fever wards, during the summer of 1902, I saw a child that was totally blind, the result of a gonorrhœal infection.

The Joint.—We occasionally meet with symptoms of inflammation involving one large joint; this is called monarthritis. An inflammation of this kind usually means gonorrhœal infection.

The Heart.—When the gonococcus enters the circulation it frequently attacks the valves of the heart. Valvular lesions are similar to joint lesions, hence we must not be surprised to see cases reported in which a gonorrhœa started at the genital tract, entered the circulation, and involved the heart. A case of this kind was reported by Leyden, of Berlin.

Pyelitis caused by an extension of this infection from the urethra may end fatally. An infection may spread from the vagina into the uterus and set up a salpingitis and end fatally. On the other hand this disease, if neglected, may assume a chronic tendency and cause sterility, so that a guarded prognosis should be given in every case until the infection is modified and the outlook is good. (Read article on "Pyelitis.")

VULVO-VAGINITIS FOLLOWING SCARLET FEVER.

At the Riverside Hospital during the summer of 1903, out of 100 cases of scarlet fever there were 15 cases suffering with vulvo-vaginitis. In these there was a well-marked purulent discharge upon the deeper parts of the vulva and at the vaginal opening, with some redness and irritation. With this there was a distinct rise of temperature and some constitutional disturbance. The cases all yielded promptly to treatment, proving especially amenable to simple astringent solutions rather than to more active germicides.[1]

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[1] Reported to me by Dr. G. L. Nicholas, Resident Physician.

It is not uncommon to find cases of vulvitis and also vaginitis occurring in the scarlet fever wards for which there is no adequate explanation.

Vulvo-vaginitis as seen at the Riverside Hospital occurs as a distinct complication to scarlet fever. When it occurs it shows a distinct rise of temperature and also a peculiar constitutional disturbance. When this is contrasted with the symptoms of a catarrhal otitis the similarity of both conditions must be apparent. Not only do we have similar bacteriological findings, but the infection manifests itself in a rise of temperature and general systemic disturbance.

While an occasional case of true gonorrhœal disease may arise in which the Neisser gonococcus will be found, from a large clinical experience in both hospital and private practice, I must say that such cases are very exceptional.

Prognosis.—The prognosis is usually good, although we must bear in mind that if these cases are neglected serious results may follow. Infection may spread from the urethra into the bladder and from the bladder into the ureters, and infect the kidneys.

Treatment.—*Hygienic Treatment:* In this disease more than in any other the strictest attention to hygienic rules is demanded. If it is an infant that is so afflicted, the pads should thoroughly cover the vulva and be saturated with a weak solution of bichloride. This pad should be adjusted with the aid of a T-binder. If there is severe itching from excoriation and the child has a tendency to scratch, the hands should be guarded so that the infection cannot be carried from the genital tract to the eyes.

Local Treatment.—Labarraque's solution is a very valuable remedy. It may be used in a 5 per cent. solution. My plan has been to add about 1 ounce of chlorine water to 1 pint of lukewarm water and irrigate morning and evening, noting the effect. If the discharge is not lessened thereby, the injection should be given three times a day.

Astringent solutions, such as sulpho-carbolate of zinc, sulphate of zinc, or sulphate of copper, using 1 grain to the ounce, are useful. When there is intense itching it is a wise plan to instill a 2 per cent. ichthyol glycerine solution into the vagina after the same has been thoroughly washed with one of the above astringent solutions.

Argyrol, 25 per cent. solution, has been used as an injection several times a day with remarkable success at the Willard Parker Hospital by Dr. Studdiford.

Constitutional Treatment.—Iron and codliver-oil should be given for several months as a restorative. Persistent local treatment alone is frequently of no avail, and I have noticed that this condition persists until iron, arsenic, or other similar tonics are given internally. The value of nutrition must not be underestimated.

VICARIOUS MENSTRUATION.

Some children have a periodical nose bleed recurring every three or four weeks. In some cases there is a considerable flow of blood lasting between two and five days. In making the diagnosis it is important to exclude all diseases due to local causes, such as polypus or hæmophilia. In one case seen by me (see chapter on "Syphilis") fatal hæmorrhage resulted in a case of congenital syphilis.

The cause is unknown.

Treatment.—The body should be strengthened and iron given internally. A change of air to the seashore or mountains will strengthen the body and frequently relieve this condition.

MENSTRUATION PRÆCOX.

We occasionally see girls from 6 to 10 years of age with regular menstruation. Literature records numerous cases of children from 2 to 5 years of age with regular recurring menstruation. Such menstruation lasts several days or in some instances several hours. As a rule such children are delicate, tuberculous, or syphilitic.

Symptoms.—There is usually pain in the abdomen similar to colic, restlessness, and a series of nervous symptoms. Such children are hard to please.

Diagnosis.—It is necessary to exclude local causes, such as papillomatous or polypoid excrescences. I have previously referred to hæmophilia and to syphilis as a possible cause. Local causés, such as masturbation or traumatism, must be excluded. As a sequela to acute infectious diseases, we frequently have vaginal catarrh. This discharge may sometimes be mixed with blood. The diagnosis depends on the regularity of the periods recurring every three or four weeks.

Treatment.—Warm demulcent drinks and the avoidance of cooling liquids. The child should be kept in bed and warmly dressed.

If the bleeding is very profuse then 5 to 10 drops of fluid extract of ergot (Squibb's), or hydrastinin hydrochlorate, $^1/_{10}$ to $^1/_{20}$ grain, three times a day, may be given. An ice-bag over the abdomen will frequently relieve severe pain and check profuse bleeding.

CHAPTER VII.

DISEASES OF THE KIDNEY AND BLADDER.

THE KIDNEY.[1]

THE kidneys of an infant are proportionately larger than in adult life. They are also situated lower than in the adult. The large size of the liver in infancy is the reason for the difference in position of the right and left kidney. The right kidney is situated lower than the left. The suprarenal capsules are much larger than in the adult. After the second year the kidneys assume the position usually occupied by the adult kidneys.

ACUTE NEPHRITIS (ACUTE GLOMERULO-NEPHRITIS: ACUTE BRIGHT'S DISEASE).

Primary nephritis is by no means a rare condition in childen. In the majority of text-books nephritis is described as the complication of infectious diseases. It is true that it is most often seen following the acute infectious diseases. In primary nephritis the source of infection is sometimes hard to trace. Pathogenic bacteria can reach the kidneys through the circulation and thus set up nephritis.

Etiology.—The influence of exposure, "taking cold," must be looked upon as an associated factor in the causation of this disease.

Comby [2] explains this as follows:—

In the absence of a specific process, such as scarlatina, diphtheria, etc., we are led, upon the occurrence of acute simple nephritis, to suspect the influence of cold. The action of cold, however, is not always direct. In nephritis, as in pneumonia, cold alone does not cause the disease. It enfeebles the organism, increases its receptivity, augments the virulence of microbes, and opens the gates by which they enter. Children carry within themselves, in the mouth, pharynx, and nasal passages, various microbes which only await an opportunity of wakening into activity. This opportunity is afforded them by the impression of cold.

The sore throat which so often precedes nephritis constitutes a first step toward the invasion by pathogenic microbes. The epithelial barrier is broken down, the micro-organisms reach the lymphatic glands, where they are often arrested or may continue their progress, passing into the circulation, and finally excite a distant inflammation which may be, according to circumstances, a pneumonia, an endocarditis, or nephritis, etc.

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[1] The urine, its physiological and pathological condition, is described in detail in the chapter on "Urine," Part XII.

[2] "Néphrite Aigue Simple des Enfants," par le Dr. J. Comby, La Médecine Moderne, December 1, 1897.

In some cases an apparently most trivial angina becomes complicated with swollen cervical glands, and, subsequently, with acute nephritis, etc. Cases have been described as glandular fever, or, in other words, acute adenitis, symptomatic of pharyngeal infection, in which nephritis has developed, superadded to the original disease, which it finally survives. These complications are not fortuitous, but are linked together in strict sequence.

Pathology.—Inflammation of the kidney in a large majority of cases commences as a glomerulo-nephritis, the delicate walls of the capillaries, and their equally delicate epithelial investment being the earliest to suffer; and instead of the non-albuminous urine, one laden with albumin escapes. If the inflammation still progresses, corpuscles, especially the red, make their way out and produce smoky or bloody urine, the naturally high pressure in the glomerulus no doubt greatly facilitating the diapedesis. The casts which may now appear consist for the most part of fibrin, of red and white corpuscles, and of renal *débris,* moulded in the tubes.

The glomerular disturbance is followed by that of the rest of the vascular net-work and of the gland cells. The latter become swollen and "clouded," and are readily detached. The swollen cells may occlude the lumen of the ducts and press upon the vascular tissue without. Or the capillaries are congested and exudation swells the intertubular tissue. In any case the tissue is enlarged and softened. Sometimes during life the signs of nephritis are well marked, but after death the anatomical lesion appears very slight; in these cases comparison with a normal kidney, both to the naked eye and under the microscope, is invaluable, as then some change can usually be detected.

The kidney of typhoid and diphtheria serve as examples, although there are numerous acute specific diseases which are accompanied by nephritis and albuminuria. The glomeruli are enlarged, owing to swelling of the interstitial substance and to engorgement of the capillaries and often swelling of the endothelial cells; there is in addition an increase in the number of nuclei in the glomeruli. Bowman's capsules may be slightly distended, their endothelium swollen or proliferating, and the spaces occupied by fibrin or white or red corpuscles. There may be an increase in corpuscles around the roots of the glomeruli. The tubules may be dilated, the epithelium swollen and granular, or there may be some proliferation. Casts are numerous, though usually hyaline; they may consist of blood. Small hæmorrhages are frequent, especially in diphtheritic kidneys.

Acute nephritis in the new-born has been described by Jacobi.[1]

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[1] New York Medical Journal, January, 1896.

Symptoms.—Gastric disturbances, such as vomiting, are very frequently noted. As a rule premonitory symptoms are absent. Nephritis frequently begins with fever, loss of appetite, headache, and general malaise. Swelling of the face is sometimes the first sign of trouble.

The urine is always scanty and sometimes contains red blood-corpuscles, leucocytes, and casts. The urine shows the evidence of acute renal congestion and is *always albuminous*. In grave cases there are frequent efforts to pass urine, and these attempts are attended with pain. With great difficulty the child expels a few drops of dark colored urine. According to the severity of the case these symptoms subside after a period varying from ten to thirty days. Irregularity of the pulse is frequently noted, and should always be looked upon as an evidence of toxæmia. It is a grave symptom.

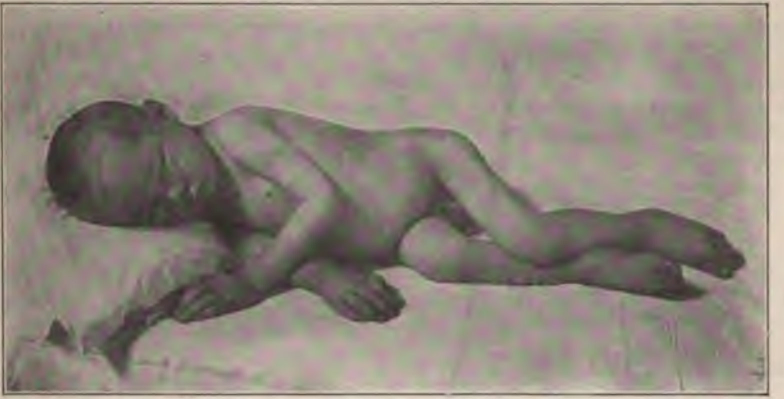

Fig. 120.—Nephritis Complicating Diphtheria. Case seen by me at the Willard Parker Hospital. (Original.)

The action of the heart should be closely followed in every case of nephritis.

Prognosis.—This is usually good. If treatment is neglected in an acute nephritis, a chronic nephritis will result. In rare instances a general toxæmia may cause convulsions and death.

Nephritis a Complication.—This disease may accompany or follow scarlet fever or diphtheria. It is also occasionally seen in most infectious diseases such as typhoid, measles, varicella, pneumonia, influenza, malaria, meningitis, and empyema.

In a study of gastro-enteritis made by Baginsky, the frequent association of nephritis was noted. This author found that the bacterium coli could frequently cause acute nephritis.

Elaine K., a girl, 5 years old, had vomiting, followed by an eruption of scarlet fever covering the entire body. The rash was distinct for three days and then faded. The physician in attendance said it was a case of mild scarlet fever. The child was up and about during the second week following the eruption. The stomach was not carefully guarded, as the child was given a too liberal diet. On the twelfth day from the beginning of her illness she suddenly had what the family called a sinking spell. Evidences of heart weakness were noted. Two days later, or on the fourteenth day of her illness, she was again put to bed. At this time she complained of pains in her joints. The glands of the neck were swollen. The urine was somewhat scanty. On the seventeenth day she had three *very severe convulsions.*

Owing to the careless management of this case, the family discharged the first attending physician. Later the family called Dr. M. Pechner, who saw the severe toxæmia and noted the anuria. I saw this case twenty-one days after the beginning of the disease, through the kindness of Dr. Pechner. The diagnosis of nephritis was easily made. Hardly an ounce of urine was passed during the day. The child was œdematous and had the waxy appearance seen in acute nephritis. The heart sounds were muffled. The pulse-rate was slow and irregular. The temperature was very slightly elevated, although a severe myocarditis existed. The child was placed in bed, under the care of two trained nurses.

Treatment.—Hot packs, diaphoretics, and diuretin, in doses of 5 to 20 grains, three and four times a day, were given. Hot saline colon flushings at a temperature of 115° F. were ordered to stimulate diuresis. A bland liquid diet aided by liquids, lemonade, and cream of tartar, formed the main treatment. The child made a brilliant recovery, to the credit of Dr. Pechner. There were no complications after the disappearance of the nephritis.

Secondary Nephritis.

Secondary nephritis, following the acute infectious diseases, can best be studied by taking the type most frequently met with, namely, post scarlatinal nephritis. (See chapter on "Scarlet Fever" for a complete description of this condition. Note also the microscopical appearance of the urine in the same chapter, page 658.)

Treatment.—Cream of tartar lemonade, a teaspoonful of cream of tartar, added to a tumblerful of ordinary lemonade, and sweeten. This should be given freely. Another drug that has served me very well is diuretin; this should be administered in doses of from 3 to 15 grains, depending on the age. This can be repeated every three or four hours, depending on the severity of the case. When diuretin is not well borne by mouth, I give it in the form of suppositories per rectum.

The following has served me very well as a diuretic in nephritis when the urine was scanty:—

℞ Potass. citrat.	$2\,{}^{1}/_{2}$ drachms
Ext. buchu. fluid	$2\,{}^{1}/_{2}$ drachms
Ext. uva ursi fl.	1 drachm 1 scruple
Syr. limonis	2 ounces
Aqua	q. s. ad 4 ounces

Sig.: Teaspoonful every two or three hours.

Calomel or podophyllin, in small doses, ${}^{1}/_{20}$ grain, repeated every two or three hours, is sometimes valuable in this condition. Lithia water and the alkaline waters are generally indicated. An infusion made by scalding the ordinary parsley root (rad. petrosilini), using about one teaspoonful of the chopped root to a teacupful of boiling water, strain and sweeten. This can be given in large quantities whenever the child is thirsty. Sweet spirits of niter in doses of $^1/_2$ teaspoonful, gradually increased, for a child 1 to 5 years old, and repeated every three hours, is a safe and efficient diuretic.

Jaborandi or its alkaloid, pilocarpine, are frequently advised as diuretics. I have frequently seen such cardiac depression follow their administration that I invariably warn against their use. In conclusion, I desire to lay great stress on the weakness of the heart frequently noticed after the administration of the hot-air bath. In one instance where I was called in consultation, the child died during the administration of such a bath.

PERINEPHRITIS.

An acute inflammation involving the cellular tissue which surrounds the kidney, as a rule terminating in suppuration. Some cases may resolve without suppuration.

Etiology.—It may be associated with, or due to suppurative process in the kidneys. It is also found in tubercular conditions. The most frequent cause undoubtedly is traumatism. Idiopathic conditions are frequently a distinct factor.

Perinephritis is not of frequent occurrence. Townsend gives the following statistics: "Nieden, in 1897, found records of 166 cases. Twenty-three of these were under 15 years of age, the youngest being five weeks old. In 1880 Gibney reported a total of 28 cases; the ages varied from 1 $^1/_2$ to 15 years. In 16 there was suppuration; in 12, no suppuration. In 19 cases no cause was found; in 8 cases a cause was given. Fenwick reports 76 cases: 4 children under 10 years, and 9 between 10 and 20 years, the youngest being fourteen months old. Kustre makes a report of 230 cases, 24 under 10 years of age, 17 between 10 and 20 years. Johnson, in an experience of nine years in Roosevelt Hospital, saw but one case in a child, a perinephritic abscess in a boy of 10 following a fall, not complicated by a kidney lesion. Israel, in a report of 43 cases, speaks of one in a patient 12 years old."

Out of 3689 patients treated in the outdoor department of the Children's Hospital for the Relief of the Ruptured and Crippled, in New York, during 1894-1903, only 6 cases are reported by Townsend.

Pathology and Bacteriology.—As a rule 80 per cent. of the primary cases terminate in abscess. In secondary cases an abscess is always found. The pathological condition is the same as is found in every acute inflammation. The pus contains either the streptococcus, the staphylococcus, or colon bacillus. In rare instances the pneumococcus and the typhoid bacillus are present. In tubercular manifestations the tubercle bacillus will be found.

Symptoms.—A child that has been in good health will suddenly develop pain in the region of the kidney near the vertebra. The pain extends downward and simulates sciatica. Moving the body increases the pain, hence the spine is generally rigid. For this reason alone many cases are mistaken for Pott's disease. There will also be fever, the temperature ranging between 102° and 104° F. If the child is old enough to complain, then chills will be noted. In the ileo-costal region there is usually a palpable tumor. Children so afflicted will refuse to walk on the affected side, and will limp. They describe the pain as though it were in the groin, in the hip, or sometimes in the knee-joint. If pyelitis complicates, the urine will contain pus. Owing to the passive condition there is constipation.

A. B., 9 years old, complained of pain in the groin and also in the back on the left side. He limped and could not stand on his left leg. He complained of chills and his temperature rose to 103° F. He urinated very frequently. After a careful examination the urine was found to contain nothing abnormal. The boy was put to bed. The bowels were flushed. Owing to small roseolar spots which appeared, typhoid fever was suspected. The blood reaction for Widal was absent. The urine gave no diazo reaction. The pain increased, and after ten days of expectant treatment a swelling was noted in the loin.

This swelling gradually increased in size until it was as large as a hen's egg. A surgeon was called who diagnosed perinephritis. An incision was made and two ounces of pus liberated. The wound was packed with sterile gauze, and with rest, iron, and strychnine internally, the boy recovered in about five weeks.

Diagnosis.—This condition may be confounded with hip-joint disease, but hip-joint disease develops *very slowly* and has a tendency to become chronic. The symptoms, while very similar in perinephritis, *develop suddenly* from within a few days to a few weeks, and recovery may occur within a few weeks after the first symptoms are noted. In hip-joint disease the symptoms extend over months and years.

The Blood.—An important diagnostic point is the increase in the number of leucocytes, such as we find in purulent conditions in other parts of the body. In tuberculosis there is no leucocytosis unless sepsis exists.

Prognosis and Course.—Primary perinephritis runs an acute short course of a few weeks and usually terminates favorably. Gibney reports 28 cases, all of which recovered.

Treatment.—Rest in bed and a warm poultice over the affected area to hasten suppuration. The abscess should be treated on strict surgical principles. No time should be lost when fluctuation is felt, owing to the danger of pus burrowing into the peritoneal cavity.

Restorative treatment, such as diet, fresh air, iron, and codliver-oil, should form the basis of the building-up process.

PYELITIS (PYELONEPHRITIS).

This condition is rarely met with in practice. Literature records isolated cases. Monti, of Vienna; Baginsky, Steffen, and Holt are among those who have reported cases of this kind.

Causes.—Pyelonephritis occurs at all ages, but is more common in adult males than in the young. The exciting causes in adult males are stricture of the urethra, renal calculi, prostatic diseases, and infection by means of dirty catheters. That girls seem to have been favored by this disease can be seen by referring to the literature; thus Professor Baginsky reports three cases, all girls, in the *Deutsch. Med. Wochenschrift,* 1897, No. 25, which he discussed at the Verein für Innere Medicin in 1897. In these three cases the author was able to grow a culture of the bacterium coli from the urine. He believes the bacterium coli to be the true etiological factor in this disease. In these three cases there were marked gastroenteric disturbances, in two cases membranous enteritis and obstinate constipation. In my case here reported there was severe constipation requiring constant treatment.

Baginsky further maintains that the bacterium coli can enter the kidneys through: first, the circulation of the blood; second, the lymph channels; third, the urethra.

Escherich,[1] Finkelstein,[2] and Trumpp[3] have reported a series of cases in which cystitis was found associated with intestinal affections. Baginsky reports two cases of pyelonephritis which could be attributed to the method of using gymnastics during orthopædic treatment for the correction of congenital dislocation of the hip joint. In connection with the exercises a direct invasion of the bacterium coli from the urethra to the bladder could be traced. Other authors, as Posner, believe that external influences have no bearing on the etiology, and that the infection takes place from within the body. It is a well-known fact that gonorrhœal vulvo-vaginitis, especially when it occurs in little girls, can cause either pyelitis or pyelonephritis. This is termed the ascending variety. Chronic occlusion of the ureter may be followed by a pure pyelonephritis, without preceding cystitis, when the exciting agents of inflammation, which are present in the circulating blood, are eliminated through the kidneys and collect in the stagnating urine in the pelvis of the kidneys. Experimentally this disease can be produced in rabbits by ligating the ureter and injecting either bacterium coli or pyogenic cocci directly into the pelvis of the kidney or into the veins.

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[1] Mittheil. d. Vereins der Aerzte in Steiermark, 1894.

[2] Finkelstein, Jahrbuch f. Kinderheilkunde, Band xliii, page 148.

[3] Trumpp, *Ibid.*, Band xliv, page 249.

Pathology.—Increased pressure in the tubules from obstruction to the escape of urine; reflex irritation of the kidney; the presence of septic matter in the pelvis of the kidney and possibly in the lower parts of the tubules. Most frequently these three causes act, in succession and in the above order, in the same case. As a rule, when acting singly, increased pressure from obstruction will produce hydronephrosis; reflex irritation will excite one of the transient or congestive types of urinary fever; and septic matter in the pelvis of the kidney will cause acute or suppurative pyelonephritis. Increased urinary pressure alone often produces chronic interstitial nephritis as well as sacculation and dilatation of the kidney; but it rarely, if ever, causes acute or subacute interstitial nephritis. Decomposition of urine in the bladder or pelvis of the kidney may produce suppurative changes in the kidney. If the dilatation of the kidney is not complicated by suppurative pyelitis hydronephrosis results. If it is so complicated, pyonephrosis is produced. Klebs and others believe that bacteria have migrated to the pelvis and calices of the kidney, there to produce their destructive changes, hence the names of parasitic nephritis and pyelonephritis as proposed by Klebs.

Lindsay Steven in a thesis on the pathology of the suppurative inflammations of the kidney, published in the *Glasgow Medical Journal,* September, 1884, corroborates Klebs's view and expresses a decided opinion that micro-organisms are at the root of the infection, and cause the formation of multiple renal abscesses consequent on diseases of the lower urinary passages. He, however, considers that there are two ways whereby the particular virus gains access to the kidney and sets up suppuration in many different points, namely: first, by means of the uriniferous tubules, and second, by means of the lymphatics of the ureter and kidney.

Steven shows that the lymphatics, quite independently of any other channel, may form the pathway of the virus from the bladder to the kidney. He admits that the two ways may be more or less combined in many cases; so that multiple miliary abscesses may originate in the same kidney, partly by the invasion of micrococci along the ureter and uriniferous tubules, and partly by their inroad along the lymphatic tracts of the kidney.

Traube and others who do not think that the bacteria themselves excite the inflammation, consider that these organisms cause the decomposition of urea into carbonate of ammonia and that this in turn excites the inflammation of the mucous membrane of the kidney.

Hannah W.,[1] 12 1/2 years old, was first seen by me in April, 1900. Her mother stated that she had been a healthy child from birth until she reached the end of four years. The child was breast-fed for one year, had no gastric nor intestinal trouble and appeared to be healthy. Dentition commenced at ten months and the child walked when she was sixteen months old. She commenced to talk about the thirteenth month. When 4 years old the child had measles and chicken-pox. She was put in bed and the usual diaphoretic remedies used in households were given; the family did not deem it necessary to call a physician. Following this attack of measles the mother does not remember whether there was desquamation, but states that the urine was thick and cloudy.

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[1] Child presented to the Section on Pediatrics, of the New York Academy of Medicine, November 8, 1900, by Louis Fischer.

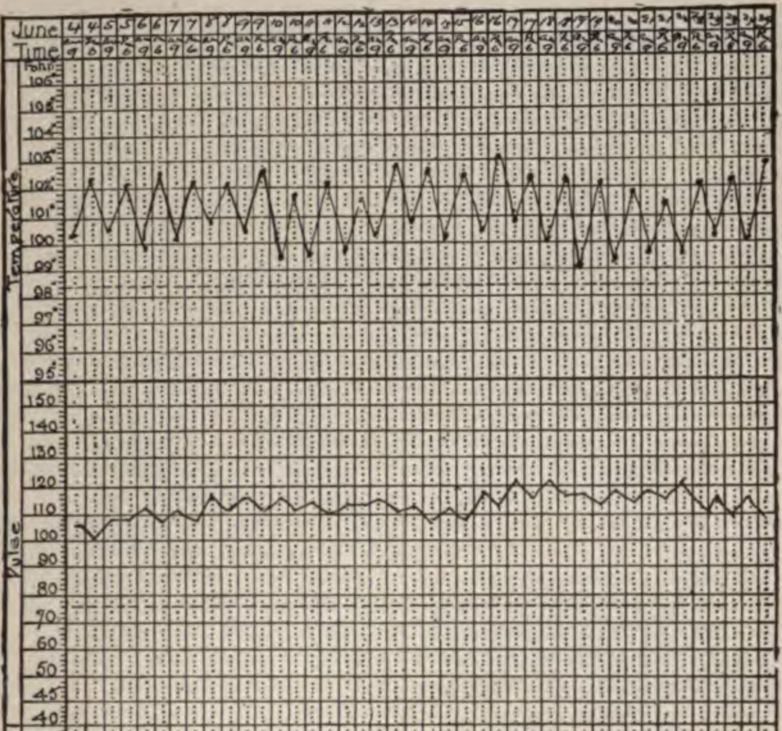

Fig. 121.—Case of Pyelonephritis. (Original.)

When first examined I found a very poorly nourished child, with sallow complexion, and flabby muscles. Her bowels moved sluggishly, she was, in fact, constipated. There was anorexia and general apathy. She complained of abdominal pains, mostly on her right side in the hypochondriac and iliac regions, the pain being constant and increased on palpation.

She complained of chills and also felt feverish. A physician had treated her for malaria, although the blood was not examined for plasmodia. She had never vomited.

Family History.—There are two other children, both in excellent health. The mother has never had any miscarriages and syphilis can be positively excluded. There is no history of tuberculosis nor anything which leads to the suspicion of tuberculosis.

Objective Examination.—A large tumor was seen and easily felt on the right side of the abdomen. This tumor was about three inches in length and about four inches wide, and absolutely dull on percussion. On auscultation nothing except occasional gurgling in the ileocæcal region could be heard. On bimanual palpation with one finger in the rectum and the palm of the hand pressing over the tumor externally, this large mass could be easily moved, but always caused pain on external pressure. When the finger in the rectum pressed upward against the tumor the child complained of pain in the right inguinal, ileocæcal and the umbilical regions. The tumor felt very hard and solid. The urine was examined many times by myself and also sent to a laboratory for a corroborative chemical examination. Large quantities of albumin, casts, and blood were found; leucocytes were also present. At no time could pus be found in the urine. This fact rendered the diagnosis very difficult. As the tumor completely involved the region of the right kidney I advised an operation. The pains were continuous, constantly increasing in intensity, and the fever ranged from 100° to 103° F. in the mouth. There was rapid emaciation owing to the loss of appetite, no food being taken for a great many days. The weight of the child, immediately before the operation, was 69 pounds. Her weight had fallen in a few weeks from 72 pounds, in spite of the administration of concentrated food and restoratives. The child did not have any bladder symptoms; there was neither pain nor sensitiveness in this region. The urine was very faintly acid and showed the conditions previously stated. Besides albumin and casts there were débris of casts and large quantities of epithelium. It did not seem to me as though we were dealing with a disease affecting the pelvis of the kidney.

Surgical Report of Dr. Simon Marx.—"Johanna W. was referred to me by my colleague, Dr. L. Fischer, on July 6, 1900. I find an extremely emaciated child of about 13 years of age. My examination is limited to pelvis and abdomen. Situated in the right side of the abdomen extending from the right loin posteriorly to within two fingers' breadth of Poupart's ligament in the corresponding side is a large, hard, non-fluctuating tumor the size of a fœtal head at term. Superficially the dullness cannot be defined from that of the liver, with which the tumor is evidently closely associated. Genital organs, from a rectal examination, are found normal. Patient prepared for an abdominal section in the usual fashion. July 7th, 8 A.M., a three-inch incision is made through the right linea semilunaris. The peritoneum is quickly and readily opened. The tumor is found, one of kidney origin, retroperitoneal. The posterior peritoneum is very much thickened. The upper part of the tumor is firmly adherent along its entire surface to the inferior surface of the right lobe of the liver. In order to protect the peritoneal cavity from infection, it is thought advisable before extirpating the diseased kidney, to unite both reflections of the peritoneum. This is done by a continuous catgut suture except below where the layer could not be united. At this place a large piece of sterile gauze is packed in. Above where the hepatic adhesions existed, after breaking them up by careful finger and scissor dissection, the parts are firmly packed with gauze to check the rather profuse hæmorrhage and wall off the general cavity above. The peritoneal coat (posterior peritoneum) is now split throughout the length of the tumor. Without much difficulty the peculiar lobulated kidney tumor is peeled from its bed. The tissue is so friable that it is removed piecemeal and in breaking into the pelvis, about a teacupful of pus and sandy concretions are removed. The renal vessels, both artery and vein, are destroyed and an insignificant bleeding occurs which is readily checked by Paquelin cautery and circular suture. This deep cavity is packed with many feet of narrow gauze. The hepatic gauze is removed and a single strip is substituted. Partial suture of the wound. The hepatic gauze is removed on the third day; the gauze in the bed of the renal tumor on the fifth day, and changed every alternate day. There is no suppuration and no temperature rise or other disturbance to mar this beautiful convalescence. The wound, except for the very superficial tissue, is completely closed in three weeks."

Pathological Report by Dr. F. A. Mandlebaum.—"I have examined the kidney you sent me. The pelvis was a large pus sac containing many small calcareous particles, such as are often found in cases of chronic pyelitis. Stained specimens of the pus did not show tubercle bacilli nor any other organisms. That some organisms were originally present is beyond doubt, but in long standing cases it is not always possible to detect them. The kidney tissue proper was the seat of numerous small abscesses, undoubtedly due to extension of the process from the pelvis. Sections cut from the cortex, and stained, show an intense inflammation of a chronic nature and small miliary abscesses are scattered throughout. Here and there are remnants of kidney tissue that show a chronic interstitial nephritis.

"*Diagnosis.*—Pyelonephritis; chronic interstitial nephritis."

October 18, 1900.—It is over three months since this child was operated upon and her weight, which at that time was 69 pounds, is now 98 pounds, an increase of almost 30 pounds.

As this child has but one kidney I have taken careful note of the quantity and quality of the urine passed. Thus the average quantity is about two pints during twenty-four hours. With the exception of phosphates in the urine nothing can be found that would indicate a pathological process. The mother of the child informs me that the fæces when passed are flat instead of round as in the normal condition. The child is absolutely free from pain and is, to all appearances, a healthy girl.

Prognosis.—The prognosis is grave and depends on the toxin caused by the presence of the pus. The outcome of the case depends on the disappearance of the pus in the urine, which must be watched for at times.

Treatment.—A child suffering with pyelitis should be put to bed in a cool room having plenty of fresh air and sunlight.

Dietetic treatment such as milk with some alkaline water is useful. No solid food should be permitted. Whey, soups, broths, and fruit juices may be given. Oranges and lemons, owing to their diuretic effect, are valuable. The internal use of Roncegno water or Wildungen water is also recommended for its diuretic effect.

Diuretin, in 2 to 10-grain doses three times a day, is sometimes useful. Urotropin is a very valuable drug and serves both as a diuretic and as an internal antiseptic.

The Bladder.

The bladder takes up almost all of the lower portion of the abdomen, as it is capable of marked distention when filled. To make proper physical examination the bladder should be emptied by catheter.

Rotch refers to a distinguished laparotomist who did not empty the bladder of a child before operating for an appendicitis; on opening the abdominal cavity he cut directly through the walls of the bladder. The urine flowing out reminded him of his failure to appreciate the fact that in early life the bladder is essentially an abdominal organ.

ECTOPIA VESICÆ CONGENITALIS (EXTROVERSION OF THE BLADDER: EXSTROPHY OF THE BLADDER).

This anatomical peculiarity is due to deficient closure of the neutral laminæ causing this hiatus of the abdominal wall in some cases. "The lower part of the abdominal wall, from the umbilicus or its neighborhood downward, may fail to close, and, coupled with this, there may be deficiency of the anterior wall of the bladder." This constitutes extroversion, sometimes called exstrophy of the bladder. The ureters are plainly visible and the urine dribbles continuously. The child is constantly wet and excoriated from the moisture and its irritation. The urine is passed in distinct jets or streams, and is especially noticeable when the child cries or strains.

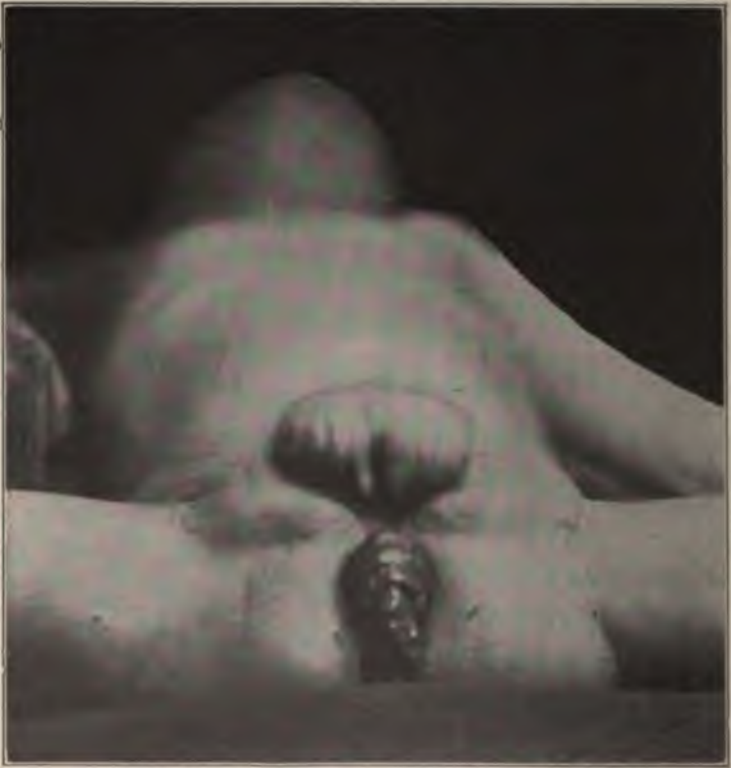

Fig. 122.—Extrophy of the Bladder, and Prolapse of Anus. (Original.)

The following case was presented by me to the children's clinic of the New York Post-Graduate Medical School and Hospital.[1]

A female infant, 1 year old, was seen by me. She was breast-fed and well-nourished. Soon after birth the mother noticed a constant dribbling of urine and attention was directed to a swelling situated in the region of the umbilicus. The diagnosis of exstrophy of the bladder was made. A bland ointment was prescribed to relieve the excoriation from the constant dribbling of urine. As this case required a plastic operation it was referred to Dr. Carl Beck, at the St. Mark's Hospital, for surgical treatment.

A child in this condition should not be operated upon until 3 or 4 years of age.

HÆMATURIA (BLOODY URINE).

Hæmaturia is known by the presence of red blood-cells in the urine. It may be due to local irritation or to systemic disease. It is therefore frequently met with during the course of a severe attack of acute nephritis, complicating scarlet fever. A case of this kind is reported in the chapter on "Scarlet Fever." I have frequently seen hæmaturia during the course of the hæmorrhagic form of diphtheria, while on duty at the Willard Parker Hospital. I have also seen hæmaturia in scurvy.

It is important to remember that irritation caused by a calculus in the kidney, the ureter, or the bladder may give rise to bloody urine. Direct injury to the kidney or bladder, or a tumor in the bladder, may cause bloody urine.

The general causes frequently met with are hæmorrhagic diseases of the new-born; the blood dyscrasiæ, such as scurvy, purpura, and hæmophilia; and infectious diseases, particularly malaria, typhoid, variola, scarlet fever, and influenza. In most of these cases the amount of blood passed is small. When it is large it may appear in the urine as clear blood or as clots, or it may impart simply a reddish or smoky color to the urine. The color, however, is not a reliable guide; the best of all is the microscopic examination. For a simple chemical test guaiacum may be used (Holt).

It is a difficult matter to discover the source of blood in some cases, although large hæmorrhage is more apt to result from the kidneys than from the bladder. To differentiate we must rely on the presence of casts from the renal tubules; thus we can satisfy ourselves of the *renal origin* of the hæmorrhage.

The prognosis depends on the amount of hæmorrhage and the general condition of the child. It should always be regarded as a bad symptom, although not necessarily fatal.

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[1] This case was also presented by me at the Scientific Society of German Physicians held at the residence of Dr. A. Jacobi about ten years ago.

Treatment.—The application of an ice-bag or dry cups over the region of the kidneys, rest in bed, Squibb's ergot, gallic acid, 3 to 10 grains, repeated every three or four hours, or the fluid extract of hydrastis canadensis, in 3 to 10-drop doses, for a child 2 years old, repeated every three or four hours, will sometimes do good.

The food is best given either cool or very cold. If the child is old enough, small pieces of cracked ice or ice cream may be given until the blood disappears.

HÆMOGLOBINURIA.

Instead of *blood cells* in the urine this condition manifests itself by the presence of *blood pigment* in the urine. Sometimes the urine is blackish. Albumin may frequently be found associated with hæmoglobin. The pathology of this condition is at present unknown. It is very easy to recognize the pigment under the microscope. It can also be noted by Heller's test. The most positive method of diagnosis is the spectroscope.

Not infrequently this condition is met with in the infectious diseases, which is evidently due to the effect of the toxins generated by the specific micro-organisms causing these diseases. When an irritant poison, such as carbolic acid, is swallowed, this condition is encountered and recognized, clinically, by the familiar term "smoky urine."

Paroxysmal hæmoglobinuria is occasionally met with in childhood. It is usually associated with syphilis. Other cases have been reported.[1]

GLYCOSURIA.

The appearance of sugar in the urine is not necessarily pathological. Grosz published a series of investigations dealing with this condition. He found that glycosuria occurs in nursing infants who have either functional or inflammatory disturbances of digestion. He did not see it in perfectly healthy nursing infants. The sugar found in the urine reacts to Fehling's test; it does not respond to the fermentation test. The polariscope shows that it has the power of dextro-rotation, so that the sugar present is possibly milk sugar or one of its derivatives.

Artificial glycosuria can be produced by administering a large quantity of milk sugar in the food, hence it may be presumed that the sugar excreted in the urine is simply the excess of what could not be absorbed in the system.

Glycosuria was frequently noted by me in the urine of children fed exclusively on Nestlé's food. When this form of feeding was discontinued, the glycosuria disappeared. These cases could therefore be classified under the head of *dietetic glycosuria.*

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[1] Archives of Pediatrics, 1902.

DIABETES MELLITUS.

Cases of this nature are frequently met with in children. The pathology is as yet rather dark. Of the etiological factors heredity must certainly be considered. Parvy reports the case of a child, 2 years old, that died of diabetes, in whose family the disease had existed for several generations.

Symptoms.—Sugar in the urine, excessive thirst, emaciation, acetonuria, and polyuria are the most important symptoms.

A case of this kind was seen by me in consultation with Dr. B. Brodski of New York City. A girl, about 10 years old, suffered with excessive thirst. She could drink several pints of water in succession, and still complain of thirst. In the same manner she passed many times more pints of urine than would be normal. The appetite was poor. The child complained of extreme weakness and showed signs of emaciation. Sugar and acetone were found in the urine. In spite of restorative treatment the case ended fatally.

Equally instructive were two cases seen by me at the children's service of the German Poliklinik. They occurred in the practice of Dr. L. F. W. Haas. They were reported *in extenso* to the Section on Diseases of Children at the meeting held at Atlantic City in June, 1900.

Prognosis.—The prognosis is always grave. When the urine contains diacetic and oxybutyric acids the condition is more serious than when the urine contains sugar alone.

Roughly stated, the duration of the disease may be about six months, although some children linger for years.

Treatment.—In the diet milk and cereals are most important. Cod-liver-oil, iodide of sodium, and Fowler's solution are beneficial. General hygienic measures, such as sending the child from the city to the country or to the seashore, may be of benefit.

COLICYSTITIS.

We are chiefly indebted to Escherich for calling our attention to this condition.

Bacteriology and Pathology.—The bacterium coli commune gives rise to this condition. The bacteria can migrate through the female urethra and set up a cystitis. When the intestinal mucous membrane is not intact, as, for example, in catarrhal enteritis, these bacteria can enter the bladder by migrating through the intestinal mucous membrane.

Symptoms.—There is fever and irritability of the bladder shown by tenesmus. The urine contains pus, sometimes traces of albumin, and has a very foul odor. As a rule the urine is milky or cloudy, or it may be dark in color. In some cases there may be vomiting and headache associated with pains in the bladder and in the back.

Prognosis.—The prognosis is good.

Treatment.—Internally, 3 to 5 grains of urotropine, several times a day, or oleum gaultheria, 1 to 3 drops, three times a day, or salol, 3 to 5-grain doses, three times a day, may be given.

Locally.—The bladder should be washed with a double current catheter. A weak permanganate of potash solution should be used, 3 or 4 ounces being injected at one time; this should be continued until several pints have been used. In some cases irrigations of a bichloride of mercury solution, 1 to 4000, repeated several times a day, may be useful.

Urethral Calculi (Vesical Calculi: Stone in the Bladder).

This condition is extremely rare in infancy. It is not so rare in children after the third year owing to their solid diet. Stone in the bladder is usually composed of uric acid, and is often the result of uric acid infarction in the kidney. In this condition calculi pass from the pelvis of the kidney through the ureters and lodge in the bladder.

Symptoms.—While urinating there will be a sudden cessation of the flow of urine. Pain either in the penis or in the perineum is sometimes described. As has been described (in the chapter on "Cystitis") whenever severe tenesmus exists causing prolapse of the rectum without definite intestinal trouble, we should suspect trouble in the bladder. Incontinence of urine is sometimes present.

Diagnosis.—If the child is old enough a diagnosis can sometimes be made by inserting one finger into the rectum and pressing over the bladder in the abdomen (bimanual examination). Although this method of bimanual palpation is frequently valuable, it sometimes gives negative results. The surest method is to explore the bladder with a sound. In very sensitive children cocaine may be injected into the urethra before the sound is passed. In exceptional cases, only with the aid of an anæsthetic, can a positive diagnosis be made.

Treatment.—Such cases should be treated by the surgeon, although an attempt at crushing the stone might be made. The radical operation of supra-pubic lithotomy may be necessary.

Very large calculi have been seen by me in the Stephanie Children's Hospital, in Buda-Pest, through the kindness of Prof. Johann von Bokai. Professor Bokai told me that from certain districts in Hungary they receive many cases of large vesicle and urethral calculi. It is therefore quite evident that the calculi are intimately associated with the geographical conditions favoring the same.

Acute Cystitis.

This condition is seldom seen in children.

Etiology.—It is most usually due to the invasion of pathogenic bacteria, such as the bacterium coli and the gonococcus.

It is most frequently the result of an extension of an infection from the external genitals through the urethra into the bladder, so that blenorrhœa in children may be an exciting cause of acute cystitis. It has also been known to arise from typhoid bacilli eliminated through the kidneys by the urine.

Stone in the bladder and intestinal irritants, such as turpentine or copaiba, have been known to cause cystitis.

Females are more prone to this affection than males.

Symptoms.—Very frequent desire to urinate, accompanied by pain on urination, is the principal symptom. The urine has a reddish color, but later in the disease has a light color. Its specific gravity is high. The reaction of the urine is alkaline. On standing there is a thick sediment consisting of mucus, pus, and blood. Microscopically, there are pus corpuscles, squamous epithelium, and blood-corpuscles. In females it is necessary to use a catheter in drawing off the urine to obtain a specimen for examination, as the epithelium of the bladder and the vagina are strikingly similar.

Prognosis.—This is invariably good.

Treatment.—Bladder washing with mild antiseptic solutions, such as a 1 per cent. boric acid or bichloride, 1 to 5000, or a weak permanganate of potash solution, is useful in some cases. Alkaline waters, such as the White Rock, Lithia, or Appollinaris in large quantities should be given.

Internally the diet should be regulated so that the child receives milk and Seltzer, thin soups and broths, fruit and fruit juices. Meat and all spices must be avoided. Only bland articles may be permitted.

Drug Treatment.—Urotropin, in doses of 5 to 10 grains, several times a day, is very beneficial, or Dover's powder, 1 or 2 grains, several times a day, will do good. In very high fever an ice-bag can be applied over the bladder.

CHRONIC CYSTITIS.

This condition is usually associated with a malignant growth in the bladder, such as a tumor, or frequently by stone in the bladder. It may also be due to a general tuberculosis with special local manifestations in the bladder. The composition of calculus is mainly uric acid, with large quantities of phosphates from the alkaline urine.

Symptoms.—From the constant dribbling of urine the child will have an offensive urine smell resembling ammonia about him.

There is an irritation around the external genitals, due to excoriation from the moisture. If stone is the cause of this condition the urine will be interrupted while passing and the child will complain of pain. The pain is difficult to localize, although it is described as being at the end of the penis. Girls will localize the pain at the meatus. From severe tenesmus there may be prolapse of the rectum.

The urine resembles the urine of an acute cystitis. Tubercle bacilli are found in bladder tuberculosis.

Prognosis.—This depends upon the condition of the child and on the cause of this affection. A cautious prognosis is necessary in tuberculous affection, or if a tumor exists.

Treatment.—If a stone is present the treatment is surgical. Urotropin and salol are very valuable, and I have seen permanent benefit from their use.

℞ Sodium sulpho-carbolate................................ 25 grains

Sig.: Divide into 5 powders. One powder every three hours in an alkaline water, is also beneficial in some cases.

Bladder washing and the diet as described in the article on "Acute Cystitis" should be employed in chronic cases.

When there is a general atony of the body then this condition will frequently result in the weakening of the sphincter vesicæ muscle or in the spasm of the detrusor urinæ muscle. Other conditions causing enuresis are lithiasis vesicalis, and where stones are suspected the bladder must be very cautiously inspected.

Children that convalesce from a severe form of disease, such as typhoid fever or any long existing febrile disorders, will usually have enuresis as a result of a general breaking down of the body wherein the muscles lose their tone.

Other conditions causing irritation may be enumerated as congenital phimosis or adhesions of the prepuce, strictures of the urethra, also irritations from worms, such as ascarides, commonly known as pin-worms; fissures of the anus; frequently also in older children, masturbation and vulvitis may be considered as possible causes of this condition. (Read chapter on "Lithuria.")

Calcareous deposits in the kidneys or stone in the bladder, the overloading of the urine with lithates or phosphates, have frequently caused abnormal irritations resulting in enuresis.

ENURESIS.

An involuntary emptying of the bladder during the day is known as enuresis diurna. When this condition exists at night it is known as enuresis nocturna.

Causes.—*(a)* Organic; *(b)* functional.

Organic Causes.—Any inflammatory condition involving the urethra or bladder, or diseases of the brain or spinal cord, frequently cause this condition.

Thiemich[1] considers this condition, when occurring in a child who has been clean for months or years, and who shows no sign of organic disease of the urogenital or nervous system, as a sign of that general neurosis, hysteria. In children hysteria usually occurs in a monosymptomatic form. The children who suffer from enuresis at some period usually come of a neuropathic family, and later show some other symptoms of hysteria.

Functional Causes: Adenoids.—It is not infrequent to find that obstructions of the nose and in the naso-pharyngeal spaces can cause enuresis. One of the most frequent causes met with is adenoids. It is a safe rule to examine the pharyngeal vault when enuresis exists. My experience has been that over 50 per cent. of the cases of enuresis seen in my clinic have adenoid vegetations.

Tight Prepuce.—If other irritations, such as a tight prepuce exist, then circumcision must be insisted upon. If irritation exists in the urine on account of an excess of lithates or phosphates, then internal treatment must be directed toward relieving this condition. (Read article on "Lithæmia.")

Prognosis.—The prognosis of this condition is usually good. In obstinate cases it may be valuable to insist on a change of air; thus, removing the patient from the city to the country or to the seashore is of value in some severe cases.

Treatment.—A very bland, non-irritating diet, consisting of cereals and milk, will be indicated. All spices, alcoholics, coffee, and tea must be prohibited. Do not permit liquids to be taken before retiring. It is also important to have the bladder emptied immediately before retiring.

Drug Treatment.—One of the best drugs is strychnine in doses of $^1/_{100}$ grain, three times a day, gradually increased. In addition thereto small doses, $^1/_{10}$ grain, gradually increased, of the extract of belladonna. When a general atony exists then nothing will be better than iron given in the form of elixir of quinine, iron, and strychnine. Massage and gentle friction of the whole body, cold sponging, especially of the spine, are valuable adjuvants to the treatment of this condition. A cold douche directed to the spine, especially to the lumbar region, will be found of great assistance.

Fowler's solution and iron are very valuable in weak children.

For incontinence of urine, internally may be given:—

℞ Ext. rhus. aromaticæ, fl.	10 minims
Syrup aromatici	20 minims
Aq. destillatæ, ad	1 drachm

Sig.: This amount to be given three times a day.

Or:—

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[1] Berl. Klin. Woch., vol. xxxviii, No. 31.

℞ Liq. atropinæ sulphatis	$1^1/_2$ drachms
Liq. strychninæ hydrochloratis	45 minims
Syr. aurant	ad 1 ounce

Sig.: For a child 14 years old, 5 drops at night; increase gradually. Younger children in proportion.

The Use of Electricity.—Faradic electricity applied over the bladder, and also over the lumbar region of the spine for several minutes every day, and gradually decreased to every two or three days, is of value in some cases.

According to Thiemich, excellent results are obtained by means of painful faradization, not necessarily of the sphincter vesicæ, but of the arms, back, or thighs. Care should be taken to prevent the impression that the treatment is a punishment, but instead it should be explained that the measure is certain of success, even though painful. More than one application is rarely required if care and tact be exercised. As in all forms of hysteria, isolation and removal from home are the most potent of all remedies.

Mechanical Treatment.—The passage of cold sounds and dilatation of the urethra by this means is sometimes very effectual. Elevating the foot of the bed is of value in some cases. The child should not be allowed to sleep on its back. To prevent this position it is advisable to tie a towel around the child's body so that the knot is in the center of the back. This will awaken the child if it turns on its back and will compel it to sleep on the side.

PART VI.

DISEASES OF THE RESPIRATORY SYSTEM.

CHAPTER I.

DISEASES OF THE NOSE AND THROAT.

ACUTE NASAL CATARRH (RHINITIS, CORYZA).

INFANTS sneeze normally during the first few days of life, the mechanical irritation of dust in the air being the cause of the same. The great difference between the intrauterine temperature and the temperature of the air renders the new-born baby sensitive and invites respiratory catarrh.

Etiology.—Pyogenic bacteria are certainly the cause of the disease. They will be found in the nasal discharge.

Rachitic infants are more prone to nasal catarrh than others. It is most likely contagious. Several children in the same family will have the disease at the same time. The handkerchief can no doubt carry the contagium from one to the other.

Children in many families have a predisposition to catarrh. There are two great extremes:—

1. Children that are kept indoors and muffled up so that their bodies are overheated, are very sensitive to exposure, and will have nasal catarrh if exposed to a draught.

2. Those children who, in order to be "hardened," are over-exposed when their skin is still sensitive.

Symptoms.—There is a hyperæmia in the nasal passages causing obstruction. This will compel the infant to breathe through the mouth. Where nasal catarrh exists there is always an interference with the feeding. The nose being stuffed, the infant must breathe through the mouth. There is usually a slight elevation of temperature. The secretion which at first is thin and mucous, later on assumes a muco-purulent character. This latter discharge is thick and sticky, and while drying obstructs the nostrils.

Persistent catarrh calls for an exploration of the vault of the pharynx and suggests adenoids. If present, no other treatment but their removal will remedy the catarrh.

Diagnosis.—Acute nasal catarrh must not be confounded with syphilitic rhinitis. The history should be carefully noted. Rhinitis is one of the earliest symptoms of measles, hence the buccal mucous membrane should always be examined for the presence of an enanthem.

If the temperature is high—102° to 103° F.—and there is an eruption, then the possibility of measles should not be overlooked. In all cases of measles the pharynx and tonsils should be carefully examined. Diphtheria of the pharynx frequently has an acute rhinitis associated with it. Pertussis is very often preceded by rhinitis. Inflammation of the lachrymal duct is at times associated, causing acute conjunctivitis. Sometimes the inflammation will extend through the Eustachian tube and cause otitis. In older children deafness is frequently caused by closure of the Eustachian tubes.

Treatment.—*Hygienic Treatment*: Put the child to bed if there is fever, but if the temperature is normal then keep the child indoors in a room with a temperature of 70° F. The body should be warmly clad after having been given a good tub bath, followed by friction with a coarse Turkish towel.

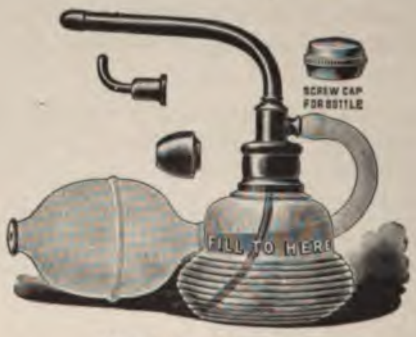

Fig. 123.—Atomizer.

Rhinitis tablets, containing the following ingredients, for the prophylactic and general treatment of catarrh of the nose and throat, have been used by me:—

℞ Soda salicylate	1 grain
Tinct. aconite	1 minim
Tinct. belladonna	$^{1}/_{10}$ minim

The above quantity is for one tablet.

One tablet can be given with water every three or four hours to a child 2 years old; smaller children in proportion.

Medicinal Treatment.—The gastro-intestinal tract requires cleansing. A drachm of castor-oil at the commencement of treatment is beneficial. The best drugs are quinine and belladonna given internally. The quinine chocolates, 1 grain of quinine, can be given to a child 1 year old; to an infant six months old one-half the dose. Fluid extract of belladona, $^1/_{16}$ to $^1/_2$ minim, three times a day. Salol tablets, containing 1 grain of salol, can be given with benefit every three or four hours.

Local Treatment.—A solution of adrenalin chloride, 1 to 10,000, may be used to cleanse the nostrils in very young infants. In older children a solution of 1 to 4000 may be used for the same purpose.

The discharge can also be removed by irrigating with a 1 per cent. boracic acid or borax solution or a 1 per cent. table salt solution, containing some glycerine, with an atomizer (see Fig. 123) or with Lefferts' posterior and anterior nasal syringe, followed by an alboline spray. The following prescription is useful for the nasal toilet:—

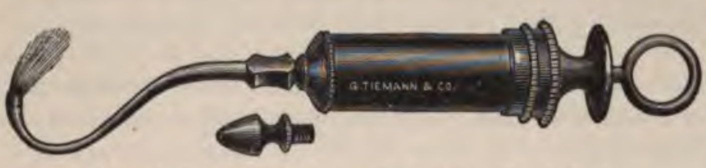

Fig. 124.—Lefferts' Posterior and Anterior Nasal Syringe.

℞	Listerine	$^1/_2$ ounce
	Table salt	1 drachm
	Borax	1 drachm
	Water	8 ounces

Listerine is a combination containing the essential oils of thyme, eucalyptus, baptisia, gaultheria, and mentha arvensis.

Other valuable preparations for cleansing the naso-pharyngeal spaces are Dobell's solution, borolyptol, and Seiler's solution.

DOBELL'S SOLUTION.

℞	Sodium biborate	1 drachm
	Sodium bicarb.	1 drachm
	Glyc. of carb. acid	2 drachms
	Water to make	$^1/_2$ pint

Borolyptol contains 5 per cent. aceto-boro glyceride; 0.2 per cent. formaldehyde, in combination with the active antiseptic constituents of pinus pumilio, eucalyptus, myrrh, storax, and benzoin.

This is a very bland, mildly astringent solution adapted for the nasopharynx. I frequently use this solution as a menstruum for carbolic acid or bichloride. All solutions used in the nose should be non-irritant, hence caustics should be avoided.

SEILER'S SOLUTION.

℞ Sod. bicarb.	1 ounce
Sod. biborate	1 ounce
Sod. benzoat	20 grains
Sol. salicylate	20 grains
Eucalyptol	10 grains
Thymol	10 grains
Menthol	5 grains
Oil of gaultheria	6 drops
Glycerine	8½ ounces
Alcohol	2 ounces
Water	to make 16 ounces

Tablets sold in shops under the name of Seiler's tablets can be dissolved in 4 ounces of water. They are of the same strength as the solution here mentioned.

Cocaine and eucaine, which are so valuable in adults, should not be used in children. *In older children the inhalation of equal parts of tincture of iodine and aqua ammonia every half-hour will frequently abort the disease.*

Dietetic Treatment.—The nursing infant should be fed at regular intervals. If bottle-fed the same regularity should be observed. No stimulants should be given. It is unwise to give codliver-oil or other restoratives when radical treatment is called for.

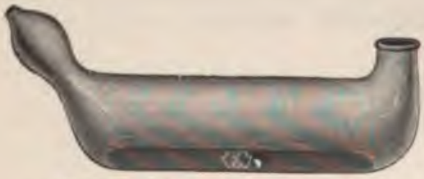

Fig. 125.—Lenox Nasal Douche.

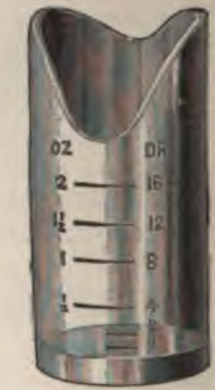

Fig. 126.—Graduated Douche Suitable for Older Children.

NASO-PHARYNGEAL CATARRH—FREQUENTLY CAUSES GASTRIC CATARRH.

The association of naso-pharyngeal catarrh with catarrh of the stomach may at first seem peculiar. When, however, the anatomical relationship of the mucous membrane of the naso-pharynx with the œsophagus and stomach are considered, an extension of the disease can easily be understood. There are certain points which have a decided bearing on the etiology of gastric catarrh when caused by naso-pharyngeal disease. Such are:—

1. The fact that children rarely, infants never, expectorate. When they have post-nasal catarrh and there is an irritation from mucous or muco-purulent secretion, infants invariably swallow the same. It is for this reason that the old-fashioned dose of ipecac or castor-oil was given, not to relieve the cough nor to hasten the expectoration, but rather to cleanse the stomach from non-expectorated secretion.

2. *Loss of Appetite.*—The loss of appetite, usually associated with severe naso-pharyngeal catarrh in which the stomach has been normal up to the beginning of the attack, is usually due to the swallowing of large quantities of this infectious secretion.

The benefit derived from curing a cold with a dose of castor-oil simply means removing some of the swallowed muco-purulent secretion from the stomach which should have been expectorated.

When catarrhal disease affecting the naso-pharyngeal space is muco-purulent and continues for a long time in very young infants, we can easily see why the loss of appetite may be the means of causing deficient nutrition. Such cases may end fatally. The importance of attending to diseases in the naso-pharynx can be seen when it is considered that diphtheria can spread from the pharynx to the œsophagus, and also to the stomach.

While it is true that diphtheritic gastritis is reported very rarely, it is well to bear such cases in mind, for they show the great danger to the stomach from an infectious catarrh located at the food entrance. There is usually a deficiency of hydrochloric acid secretion in all severe catarrhal diseases. This is most apparent in those febrile conditions which accompany diphtheria. It is for this reason that it is not very difficult for the stomach to be the seat of an infection if diphtheritic membrane is swallowed.

It is of the greatest importance to have every child's throat in a normal condition. Adenoid vegetations and diseased tonsils favor the development of malignant disease. The vast majority of patients who are infected with diphtheria, owe this infection to the diseased state of their throat, which favors the development of pathogenic bacteria. This can as easily be verified in children as in adults. *It is rare to find a case of diphtheria in which a previous normal throat existed. Hence it would seem plausible to eradicate all trifling as well as serious nose and throat disease, and aim to secure a healthy state if we are to ward off infections.*

FOREIGN BODIES IN THE NOSE.

Children frequently while playing with beans, beads, shot, etc., stick them in the nose. If allowed to remain they frequently become encrusted with carbonate and phosphate of lime. Then it is known as a rhinolith. An angular forceps or a polypus forceps has frequently dislodged these foreign bodies. A nasal irrigation into the unobstructed nostril will sometimes assist in removing the foreign body.

TONSILLITIS (ANGINA CATARRHALIS).

This is an acute inflammatory lesion, undoubtedly due to the infection of the structures of the tonsil by micro-organisms which enter the lacunæ or lymph channels.

Bacteriology and Pathology.—The tonsils[1] are lymphoid structures closely resembling Peyer's patches of the small intestine. Various species of cocci and bacilli are to be found within the lacunæ, within the closed follicles, and even within the epithelial cells of tonsils removed during the acute stage.

Leucocytes in large numbers are found associated with the microbes.

During the presence of inflammatory conditions, such as the presence of the contagium of diphtheria, desquamation of the epithelial covering takes place. This proliferation of the cells seen in diphtheria may entirely denude the tonsils of its epithelial covering in places. This will then permit any specific virus to be brought into contact with the lymphatics and then be carried into the general circulation. We see an acute inflammation of the tonsils in scarlet fever, in measles, and in diphtheria. It may also be seen in other infectious diseases, so also in acute inflammatory manifestations.

Symptoms.—One of the most frequent diseases of infancy and childhood is tonsillitis. When we are told that an infant has had a slight fever that passed off very quickly and has been attributed to "teething," tonsillitis among other diseases should be suspected.

The onset is sudden. Fever is high. The temperature reaches 102° and may rise to 105° F. Vomiting frequently occurs. On the tonsils we find intense redness, and the lacunæ are covered with whitish or yellowish-white spots, which rarely coalesce but appear as yellowish dots.

Treatment.—Immediate relief to an inflamed tonsil can be given by a spray of 1 to 10,000 adrenalin chloride. Externally a hot, flaxseed poultice, or in some cases with fever, an ice collar, will render good service.

Internally 1-drop doses of tincture of aconite, repeated every hour for five or six doses, will reduce fever, promote diaphoresis, and frequently abort the condition. A dose of calomel, $^1/_2$ grain, repeated every two or three hours until liquid stools are produced, is valuable. A steam atomizer containing a spray of beechwood creosote or pine needle oil, to be used every two or three hours, loosens viscid secretions.

Food.—As there usually is pain on swallowing solid food, it is better to give small quantities of liquid food. Ice cold chicken or calfsfoot jelly, ice cream, raw scraped pulp of meat, the yolk of raw eggs well beaten with sugar, buttermilk or zoolak, is nutritious and grateful to an inflamed throat.

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[1] Hodenpyl in the American Journal of Medical Science, March 1, 1891.

THE SIGNIFICANCE OF TONSILLITIS IN CHILDREN.

A diagnosis of tonsillitis or quinsy is usually thought to imply that we are dealing with a benign, easy-going condition. That the reverse is true is very apparent when a critical inquiry will follow the termination of each and every case. In a series of 12 cases of follicular tonsillitis taken at random as I saw them, the bacteriological diagnosis in 7 of these cases was diphtheria.

The frequency with which endocarditis and nephritis are seen implies that there may have been some antecedent disease from which pathogenic bacteria caused the valvular heart lesion, or possibly a nephritis. The following case will illustrate very forcibly the dangers of the so-called *ordinary tonsillitis*:—

A girl, 24 years old, occupation housemaid, was in good health up to the time of illness. She was exposed to cold and two days later complained of pains in the body and rawness in the throat. A physician was called and tonsillitis diagnosed. The usual remedies were prescribed, but as she did not improve she was sent to the hospital. A culture taken showed the presence of the Klebs-Loeffler bacilli. While at the Willard Parker Hospital symptoms of stenosis appeared, which required intubation.

Two children in the same family were exposed, and on learning the nature of the disease, I injected an immunizing dose of antitoxin of 500 units into each child, age 7 and 10 years respectively. The older boy had a reddened tonsil and I believe was suffering with a premembranous form of angina. No reaction followed the injection of antitoxin and both boys remained well.

The housemaid before mentioned, who was intubated and received antitoxin, died three days after being admitted into the hospital. A study of her case shows two interesting things:—

1. An apparently mild tonsillitis may frequently be a follicular form of diphtheria, wherein the crypts or lacunæ of the tonsil are the seat of the disease.

2. That Klebs-Loeffler bacilli were found, by bacteriological examination, hence the diagnosis of follicular diphtheria was correct. The disease spread downward from the tonsil, causing laryngeal stenosis, and laryngeal œdema, necessitating intubation, and ending fatally.

The post-mortem examination showed an extensive œdema of the glottis and infiltration of larynx. Pseudo-membranes were also present. When the larynx was incised, large quantities of pus exuded from below.

Another point worthy of note, is that the two children exposed to this housemaid, one of them having an angina, the other remaining normal, were immune and in perfect health after receiving 500 antitoxin units.

FOLLICULAR TONSILLITIS, OR FOLLICULAR CATARRH.

Follicular catarrh is the most frequent form of inflammation of the tonsils.

Bacteriology.—The examination of the purulent plugs of follicular angina reveals:—

(a) Staphylococcus.
(b) Streptococcus.
(c) Pneumococcus.

Staphylococcus angina is a relatively harmless inflammatory lesion passing off without complications.

The streptococcus variety is a severer type of disease associated with fever and glandular enlargement. This disease is associated frequently with a general toxæmia and may be followed by nephritis or septicæmia.

The pneumococcus form is usually ushered in with a chill and sometimes runs a course similar to that of pneumonia. There is usually a redness and swelling of the tonsils, lacunar catarrh, and increased secretion, which agglutinates and shows itself at the follicular openings as yellowish-white spots.

The lymphatic glands at the angle of the jaw are sometimes enlarged and tender on palpation.

CROUPOUS TONSILLITIS.

This is a severer form of inflammation than the one above described. It involves the whole structure of the tonsil and most especially the crypts. The large quantity of fibrin which is poured out forms a distinct pseudomembrane. It is very difficult to differentiate this from diphtheria. A culture should be taken in all cases (see the "Diagnosis of Diphtheria").

We cannot differentiate this disease from true diphtheria clinically except by resorting to bacteriological cultures.

ULCERO-MEMBRANOUS TONSILLITIS.

This disease was first described by Vincent[1] who maintained that it was caused by a fusiform bacillus, although a spirillum was found associated with it.

Microscopically, there is a spindle-shaped bacillus along with spirilli. The bacillus does not stain with Gram. A clear culture is hard to obtain.

The pseudo-membranes, whitish or grayish in color, are easily detachable until the third day, when the ulcer forms. This ulcer corresponds to the portion of the tonsil occupied by the pseudo-membrane. Around its edges the mucous membrane is reddened. The accompanying symptoms are difficulty in swallowing, fever, anorexia, headache, and swelling of the submaxillary glands. The pseudo-membrane does not increase when this piece of membrane is detached. The ulcer heals.

It resembles croupous tonsillitis in its general appearance. It is often unilateral. The yellowish exudation seen on the tonsil greatly resembles diphtheria. It is a superficial necrosis, and when this tissue is wiped away with a swab bleeding occurs.

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[1] Arch. International de Laryngologie, 1898, No. 1.

There are swollen lymph nodes at the angle of the jaw.

This disease is a local process and rarely has constitutional symptoms accompanying it.

Prognosis.—The prognosis is excellent.

Treatment.—Gargle with bichloride, 1 to 2000, or with a weak solution of permanganate.

Locally, iodine, or 3 per cent. peroxide of hydrogen or 10 per cent. nitrate of silver solution, can be repeated in twelve hours if no improvement is noted.

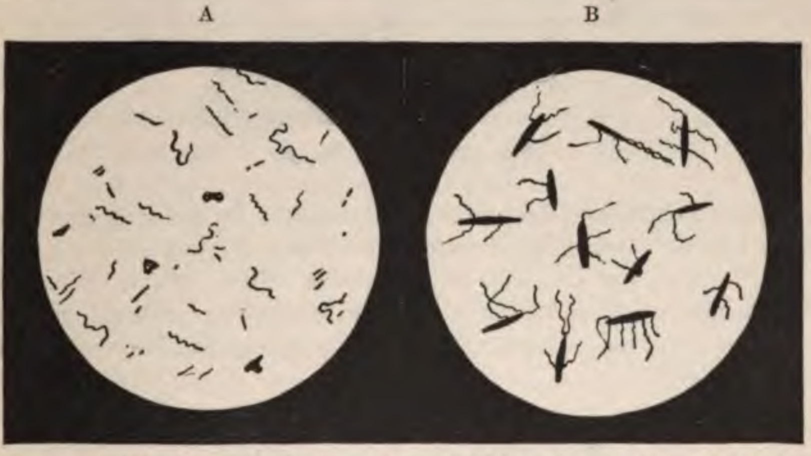

Fig. 127.—Vincent's Bacillus Found in Ulcerative Angina. A, Fusiform bacillus having a thickened center and tapering toward both ends. Also spindle-shaped bacilli. B, Fusiform bacillus having spores. (Original.)

PHLEGMONOUS TONSILLITIS (QUINSY: PERITONSILLAR ABSCESS).

This form of angina is usually caused by an invasion of the staphylococcus.

When the cellular tissue surrounding the tonsil is infected the inflammation may terminate in:—

(a) Resolution.

(b) Abscess.

It is one of the rarer forms of inflammatory conditions met with in children.

Symptoms.—The symptoms are similar to those of follicular tonsillitis. The temperature rises to 101° and 102° F. Sometimes as high as 105° F.

The child, if old enough, will complain of pain on swallowing, and at times it may be impossible to open the mouth. On examining the throat the inflammation can be seen. There is a marked congestion and œdema involving the tonsils, fauces, and uvula.

Holt reports a case of torticollis several days before the diagnosis of quinsy was established.

Treatment.—Aconite in 1-drop doses, repeated every one or two hours for the first day, will frequently abort the disease. Guaiacol carbonate given in 1 to 5-grain doses every three or four hours, has served me very well in some instances.

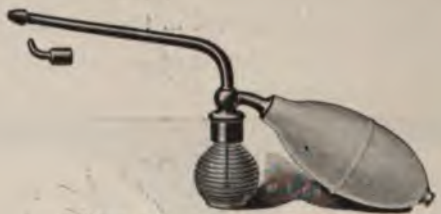

Fig. 128.—Throat Spray.

Local Treatment.—Local treatment consists in spraying the throat with a 1 to 2000 bichloride of mercury solution every two hours.

An ice-bag over the neck will sometimes relieve inflammation. The external application of leeches will relieve congestion. When fluctuation is felt the pus should be relieved by making a deep incision with a long, pointed bistoury.

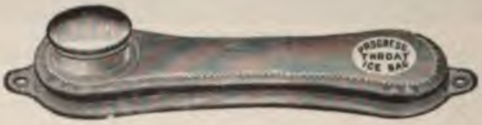

Fig. 129.—Throat Ice-bag.

The Danger of Hæmorrhage.—Laryngologists, as a rule, advise great caution in operating in this region owing to the large number of blood-vessels located there.

After the incision is made the wound should be enlarged by inserting a polypus forceps or an artery clamp and separating the blades. By this means we can easily evacuate the pus and do not run the risk of bleeding. I am indebted to Dr. George F. Shrady for this valuable surgical hint.

CHRONIC HYPERTROPHIC TONSILLITIS.

The chronic enlargement of the tonsils is due to recurring inflammatory attacks. This hypertrophy comes from a proliferation of the lymphoid tissue and an increase in the connective tissue stroma.

Etiology.—It is usually found in rachitic and subnormal children. Bad ventilation and improper hygiene are among the prime causes of this disease. In a series of several hundred children examined by me in one of my clinics for various diseases, 90 per cent. suffered with enlarged tonsils. All of these children lived in tenement houses, and we must associate the crowded, ill-ventilated apartments with the poisoned air inspired and its resulting throat disease.

Predisposing causes, such as rheumatism in the parents, have been given by some authors as causative factors.

Symptoms.—When we are told that an infant snores and breathes with its mouth open, then enlarged tonsils may be suspected as the cause. On the other hand an inspection of the post-nasal spaces should also be made to eliminate the presence of adenoids as the probable cause of the difficult respiration.

Deafness can rarely be attributed to enlarged tonsils. It is more often caused by the closure of the Eustachian tubes due to adenoids. The nasal tone of voice often accompanies enlarged tonsils.

Course.—Enlarged tonsils increase during childhood and remain permanently until puberty arrives, when they usually shrink in size without treatment.

The indications for the removal of chronic enlarged tonsils are:—

1. Where there are repeated attacks of tonsillitis.
2. Where there is inability to breathe sufficiently through the nose, with snoring, during sleep.
3. Nasal voice and deficient articulation.
4. Deafness and attacks of earache.
5. Tendency to pigeon-breast.

When any or all of the above conditions exist then a guarded opinion should be given until we ascertain whether or no the case is complicated by adenoids.

In the latter cases the removal of the tonsils will not suffice to cure the patient until the rhino-pharynx is treated for the removal of the adenoids.

There are few conditions met with in children which are more satisfactory from a therapeutic standpoint than the operation for tonsils and adenoids.

Dangers.—Desire[1] collected 20,000 tonsillotomies. In 9 cases bleeding took place. In none of these cases was it fatal, and in several it was not serious.

Lefferts[2] lays stress on the ascending pharyngeal artery as being one of the most, if not the most, prolific source of severe bleeding after tonsillotomy. It is important to inquire if *children suffer with hæmophilia* (bleeders); in such cases fatal hæmorrhage will frequently occur. I have also met with a case of congenital syphilis in which a serious hæmorrhage followed a tonsillotomy. This was evidently due to a syphilitic degeneration of the blood-vessels.

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[1] Sajous's Annual. 1891, vols. iv and v.

[2] Archives of Laryngology, vol. iii, p. 43.

The Operation.—The bistoury is rarely or never used for this operation. Some operators use a wire snare. In my experience the adjustment of a snare in an unruly child is so difficult and so much time is lost, that it is not practical. My preference has been for some form of tonsillotome. The Mackenzie type is a very good one. The Baginsky tonsillotome is one of the best. (See illustration Fig. 130.) It is simply a sharp-bladed guillotine and can be very easily adjusted.

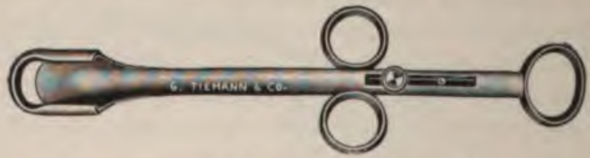

Fig. 130.—The Baginsky Tonsillotome.

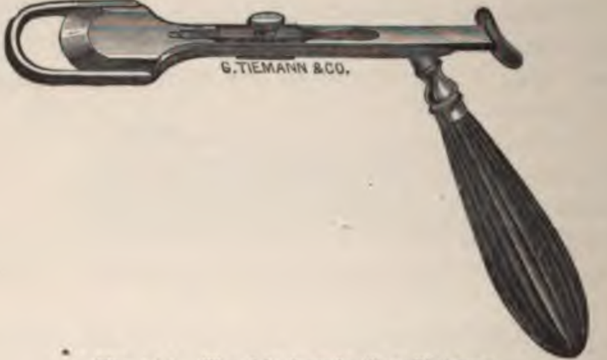

Fig. 131.—The Mackenzie Tonsillotome.

Hæmorrhage following the operation need not cause anxiety. When, however, hæmorrhage follows, then adrenalin chloride solution in full strength ($^1/_{1000}$) should be liberally used. It may be applied in the form of a spray or by means of a cotton pledget soaked with the solution. The galvano-cautery or the local application of peroxide of hydrogen is frequently useful. In older children small pieces of cracked ice or ice cream will control bleeding.

The Use of an Anæsthetic.[1]—The local application of a 10 per cent. cocaine solution has been recommended by a great many authors. I have used cocaine in children and have seen very bad constitutional effects, such as severe cardiac depression, nausea, and frequently vomiting following its use.

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[1] Read chapter on "Anæsthesia in Children," page 930.

Spraying the tonsils with ethyl chloride for several seconds produces local anæsthesia. It is very valuable with sensitive children. In some instances a few whiffs of chloroform are necessary to have the child completely under control.

Chloroform is very rapid, but it must be cautiously given.

It is advisable to operate before feeding, so that in the event of vomiting food should not be expelled.

It is advisable to thoroughly swab the mouth, pharynx, and tonsils with an antiseptic solution before the operation. For this purpose use:—

Listerine	1 part
Sterile water	5 parts

Or Dobell's solution.

Apply with a cotton swab.

Normally pathogenic bacteria abound in the mouth and post-nasal spaces. After a tonsillotomy a white croupous deposit resembling diphtheria will be seen. This should not be considered a diphtheritic infection unless the Klebs-Loeffler bacillus can be demonstrated.

Owing to the raw surfaces following a tonsillotomy the greatest care must be used to isolate the patient from infectious diseases. Scarlet fever and diphtheria will gain access much easier soon after this operation is performed.

TUBERCULOSIS OF THE TONSILS.

Schlesinger states *(Forts. der Med. Pediatrics)* that "up to the present time the parallelism between advanced tuberculosis of the lungs and tuberculosis of the tonsils, as also that between mild or passed tuberculous processes of the lungs, with the escape of the tonsils, has only been demonstrated in the case of adults, but has not been observed in children. He was able to confirm this parallelism also in children, having found 12 cases of tuberculosis of the tonsils in 13 of florid tuberculosis of the lungs. The diagnosis of tonsillar tuberculosis is hardly possible microscopically, for the reason that tubercular ulcerations are only found very rarely on their surface; neither were the tonsils hypertrophied without exception, but were found pale and firm in nearly two-thirds of the cases. In 9 cases examined for the purpose, the tonsils were found to be affected bilaterally, although not with equal intensity. As to the relation between tuberculosis of the lymphatic glands of the neck and that of the tonsils, in 9 cases the author found that the tonsils were healthy in 2. He inclines, therefore, to the view that a primary tonsillar tuberculosis is not to be taken for granted in all cases; but we must take into account the possibility of their infection by cheesy cervical glands, by means of the return flow of lymph. The author finds some support for this view from the fact that in these cases the recent tubercles are situated at the base of the tonsils away from the crypts."

L. Kingsford[1] examined the tonsils removed post-mortem from 17 children, varying in age from four months to 9 years. All showed cervical glandular enlargement, and in 11 it was obviously tuberculous. Of the 17, tonsillar deposits were found in 7, but only 3 exhibited any naked-eye tuberculous changes. Of these 3, 1 showed ulceration, a second scarring, and a third a sebaceous focus. Practically all the 17 were cases of secondary infection from either blood or sputum. The parts of the tonsils which were the seats of the lesions were usually the lymphoid follicles not far from the epithelial surface, but it is not possible to trace bacilli in from the crypts or surface of the organs. The author believes it possible that infection may work through healthy tonsils to the cervical glands, the former becoming infected at a later period.

Tuberculous tonsillitis is a very rare affection. The tonsils are rarely if ever the site of primary inoculation in pulmonary tuberculosis.

Adenoid Vegetations[2]

Adenoid vegetations consist of a hypertrophy of the adenoid tissue which exists normally in the naso-pharynx.

Pathology.—In a less severe form the growth may be confined to the roof of the naso-pharyngeal cavity. In severe forms the vegetations are very numerous, irregular in shape, and extend from the roof of the cavity to the lateral walls. They grow from the fossa of Rosenmuller. They frequently cover the orifices of the Eustachian tubes. There are frequently, according to Hall, between the enlarged pharyngeal and faucial tonsils, and sometimes the adenoid tissue at the base of the tongue, the so-called lingual tonsil.

The difference between vegetations and an enlarged tonsil is that the tonsil has a great amount of connective tissue due to the irritation produced by the passage of food, whereas the vegetations by their situation are protected from these injurious influences.

Symptoms.—The "adenoid habitus," the pinched expression of the nose and the long drawn face, are very typical. There is frequently lateral narrowing of the alveolar arch and prominence of the upper incisor teeth. Owing to the interference of respiration the mouth is kept open. The lips are swollen and thick.

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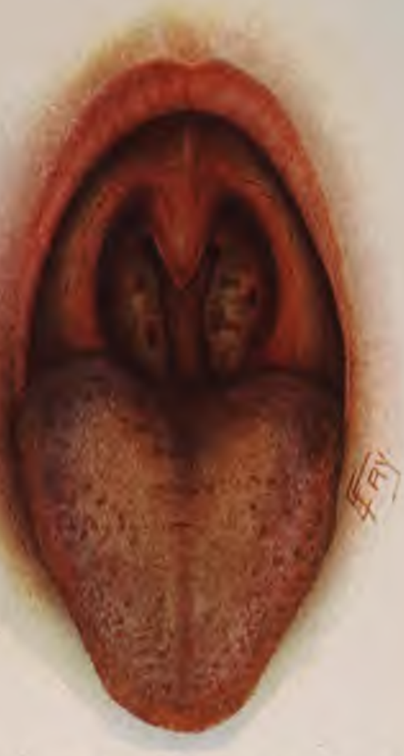
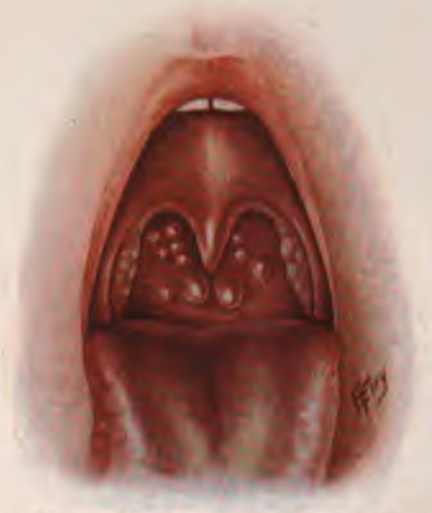
[1] The Lancet, January 9, 1904.

[2] For "Congenital Adenoids," see clinical history on page 55.

PLATE XIV



Chronic Enlarged Tonsils and Associated Congested Throat, very frequently seen. (Original.)



A case of Granular Pharyngitis. Large masses could be palpated in the rhino-pharynx. (Original.)

Spicer has directed attention[1] to the distention of the transverse nasal vein as one of the indications of the presence of adenoids.

Deafness.—Deafness is frequently caused by the presence of adenoids. The amount of interference caused by the adenoids will depend on the relation of the Eustachian tube orifice to the vault of the pharynx. If the orifice be situated high up, a small amount of growth will occlude it and cause auditory trouble. When the orifice is situated low down there may be extensive vegetations without the Eustachian tube being implicated.[2] The voice has a muffled sound with a nasal twang. The letters m, n, and ng cannot be pronounced. Stuttering or stammering can frequently be cured if vegetations are removed; the explanation being that the spasmodic actions of the muscles of the throat are due to reflex irritation. Earache frequently accompanies adenoids.

Bed wetting is usually associated with adenoids. Among several hundred children examined in the children's service of a large dispensary, it was rare to find a case of enuresis that was not associated with adenoid vegetation.

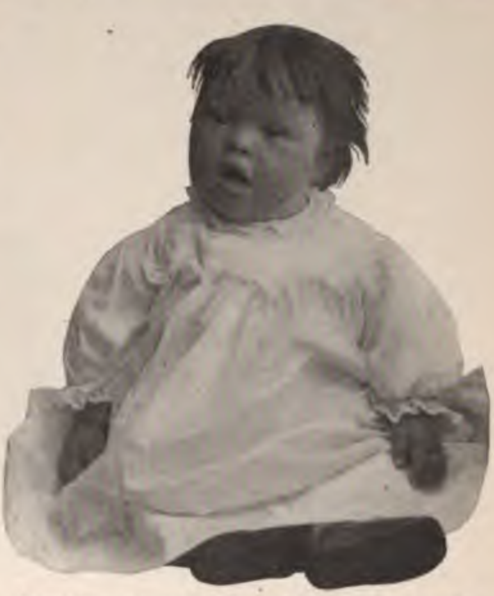


Fig. 132.—Typical Adenoid Face in a Cretin. (Original.)

Diagnosis.—The mouth breathing, the snoring at night, the adenoid face, are in themselves sufficient to establish a diagnosis. *To examine the rhino-pharynx for the presence of adenoids,* have the nurse seated with the child on her lap, firmly pinning the child's feet between her knees. While the right hand confines the child's arms, the left hand is used to support the head. The physician should then separate the jaws with the aid of a mouth gag and explore the post-nasal space with his index finger. In the absence of a gag a clean cork or the handle of a spoon protected by gauze can be used to separate the jaws.

If the child is very unruly it is wiser to pin a sheet securely across the arms and examine in the dorsal position.

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[1] British Medical Journal, 1887, p. 459.

[2] Sajous's Annual, 1888, vol. iii, p. 278.

The physician can best make the examination by standing directly behind the child.

In making a diagnosis of adenoids in infants[1] we must naturally depend to a great extent upon the inability to nurse properly and noisy mouth breathing. However many other cases of noisy mouth breathing should be excluded. These briefly mentioned are:—

1. Congenital, as:—
    - Diminution in size or occlusion of one or both nostrils.
    - Highly arched palate or deformity of soft palate.
    - Distortion of cervical vertebræ.
    - Atelectasis.
2. Constitutional, as: —
    - Syphilis.
    - Lymphatism.
    - Tuberculosis.
    - Lithæmia.
3. Other conditions, such as:—
    - Acute rhinitis.
    - Rectopharyngeal abscess.
    - Disturbances of digestion.
    - Paralysis of soft palate or pharynx.
    - Diphtheria, especially nasal.

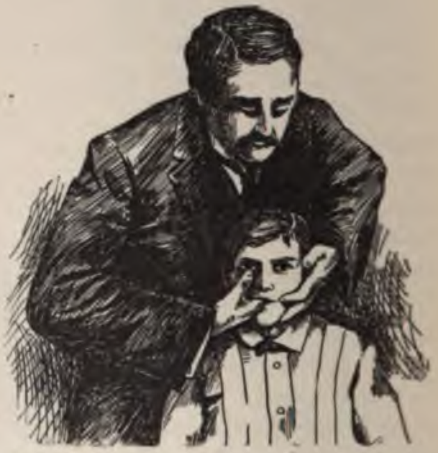
Fig. 133.—Digital Method of Exploring the Rhino-pharynx for Adenoids. (Original.)

These have to be carefully considered. These conditions may exist with adenoids, but when alone may cause symptoms similar to those occasioned by the presence of the hypertrophied tissue, so an operation may not result in the promised cure. In infants the examining finger, on account of its size, is out of the question; and the rhinoscopic mirror cannot be employed. To be absolutely certain the curette must establish the diagnosis.

Prognosis.—The disorders arising from the presence of adenoids are: Repeated attacks of coryza, chronic rhinitis, arrest of nasal development, nasal stenosis, and mouth breathing, with the associated mental listlessness. There is a tendency to bronchitis, to spasmodic croup and asthma. Children with adenoids usually have very poor appetites. There is an associated gastric catarrh. Some authors[1] state that measles, scarlet fever, and ear troubles are more frequently found in children where adenoids exist. Their presence is therefore a menace and they certainly invite infection.

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[1] Abstract of a paper read by Dr. Herman Jarecky, April, 1904, Meeting of the Society of Alumni of Charity (City) Hospital, New York.

Treatment.—Meyer, of Copenhagen, certainly deserves the credit for the plan of treatment used in these cases. The following method has been used by me for some time:—

It is best to use an *anæsthetic,* as most children with adenoids are of a neurotic temperament.

A rapid anæsthetic in children is chloroform. Some authors advise the use of nitrous oxide followed by ether as the best means of producing anæsthesia. Deep anæsthesia is uncalled for, as in that condition the cough reflex would be abolished. It is better to do the operation completely rather than put a child to the pain and discomfort of repeated sittings. Two or more sittings may be necessary if the child is not anæsthetized. The evening before the operation a 1-grain dose of calomel or a wineglass of citrate of magnesia has a beneficial effect on the bowels. The position of the child during the operation is of great importance. Some operators prefer the head over the end of the table. Butlin[2] says the patient should lie on the side with the thighs flexed, the head a little forward on a low pillow.

The Operation.—The Gottstein curette or its modification is best adapted to work in the antero-posterior diameter of the naso-pharynx. The Löwenberg forceps or its modification is used to grasp the mass and is preferred by many operators.

With the curette the portion removed is apt to be lost and might even drop into the larynx, although it is the safest instrument to use with very young children. The best type of forceps is the Graedle or its modification by Concannon. This forceps has an extensive cutting edge, hence tearing is unnecessary.

Operating Without an Anæsthetic.—The child should be placed in an upright position and held by an assistant. A mouth gag is used, and the closed forceps is introduced. The forceps is then opened widely and pressed well upward and behind. The mass is seized and the forceps withdrawn. The finger should always be introduced to be sure of the location and extent of any remaining masses. The latter can be removed with the finger, curette, or with smaller forceps.

If the Gottstein curette is used it should be carried well up into the vault, carrying the soft palate forward; then it should be brought down with a bold sweep, to the vault of the pharynx. The steel nail is frequently advised by some operators as a means of removing adenoids. In spite of the most careful treatment[3] adenoids will frequently recur.

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[1] Centralblatt, vol. i, p. 278.

[2] Lancet, vol. i, 1893, p. 363.

[3] W. K. Simpson February 13, 1902.

Hæmorrhages After Operation.—A rapid means for controlling bleeding after the operation consists in injecting the nose or the rhino-pharynx with a diluted solution of peroxide of hydrogen. I do not remember a single case of post-operative hæmorrhage where peroxide was used.

The After-treatment.—The after-treatment will consist in giving syrup of hypophosphites, $^1/_2$ drachm, two or three times a day, or the tincture of iron, given in 5 to 20-drop doses three times a day, will have a good local and constitutional effect.

The application of a diluted solution of iodine is frequently useful:—

℞ Iodine	2 grains
Potass. iodide	10 grains
Glycerine	1 ounce

M. Sig.: To be applied with a cotton swab every two or three hours.

Codliver-oil and malt extract are among the restoratives indicated for the after-treatment. The most important part of the after-treatment consists in the strict application of hygienic measures. The child should be placed in a room in which there is fresh air, windows open night and day. If a child is old enough we should teach it how to breathe. Out-of-door exercise should be insisted upon. Deep inspiration and expiration, and pulmonary gymnastics are just as important as attention to the food. Milk, meat, eggs, cereals, and fruits should be ordered, depending on the age and requirements of the case.

Retropharyngeal Abscess (Retropharyngeal Lymph Adenitis).

This condition may be due to mechanical irritation or to direct infection. The most common forms met with in children are evidently due to:—

1. Local infection.

2. Abscess caused by a tubercular infection or where caries of the cervical vertebræ exists. This latter condition we meet in older children. It is usually a sequel to the specific infections, and may follow scarlet fever, measles, or diphtheria. It is most frequently associated with influenza and tuberculosis. Rachitic and syphilitic children are predisposed to this disease. Catarrhal affections of the upper air passages also invite this disease.

Pathology.—The retropharyngeal lymph nodes are described (Simon) as forming a chain on each side of the median line between the pharyngeal and prevertebral muscles; these undergo atrophy after the third year. Sometimes adenoids will cause a swelling of the glands, giving rise to fever, but they will not suppurate. At other times the swelling of the retropharyngeal lymph nodes will be associated with external cervical adenitis. It is important to recognize this condition owing to the serious nature of the disease.

Symptoms.—This affection usually develops very suddenly; the infant will refuse the breast or have trouble in swallowing. The food is most commonly regurgitated through the nose. Such infants will have labored mouth breathing. The head is thrown back, there is severe dyspnœa, occasionally asphyxia—laryngeal stenosis due to pressure of the abscess on the larynx, interfering with respiration. There is a peculiar snoring sound. With the index finger in the throat the soft fluctuating tumor can be felt. On examining the throat with a good light the bulging of the pharyngeal wall will be noticed.

The temperature will range from 102° to 103° F., sometimes higher.

Diagnosis.—The diagnosis should be made with the finger, by a careful palpation of the post-nasal and pharyngeal spaces. Mouth breathing due to adenoids will not cause sudden symptoms of suffocation. The suddenness of interference with respiration points to the development of an abscess. The following cases will illustrate this condition:—

Case I.—An infant about fifteen months old was brought to my office by Dr. J. Martinson. The history was loss of appetite, regurgitating of food through the nostrils, mouth breathing, and bulging of the pharyngeal wall. Temperature, 101° F. Cervical glands enlarged. The diagnosis of retropharyngeal abscess was made. An incision made in the abscess liberated the pus. The abscess cavity was cleansed with a 1 to 2000 bichloride solution. The child recovered.

Case II.—A nursing infant, less than 1 year old, seen with Dr. J. Brandeis, suffered with retropharyngeal abscess. The treatment consisted in hot fomentations. When fluctuation was detected, an incision was made with a curved bistoury; the lower half of the blade was protected with cotton. After the incision the wound was enlarged by introducing and separating the blades of a polypus forceps. The child recovered.

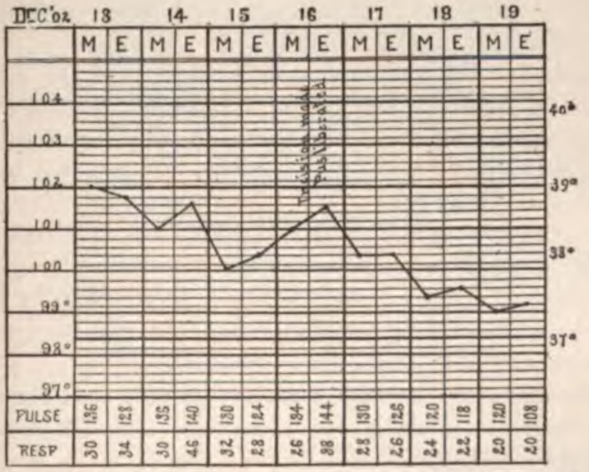

Fig. 134.—Temperature Chart from a Case of Retropharyngeal Abscess. (Original.)

Treatment.—Some children require local applications. Antiphlogistine is a convenient local application until suppuration is established. Flaxseed poultices are sometimes well borne.

No time should be lost if pus is present. The abscess cavity should be opened and the pus liberated. To prevent the pus flowing into the trachea, it is best to keep the head well forward. The use of a gag is not necessary if the tongue is depressed and the incision made with a small-bladed knife similar to a tenotome. After the pus is evacuated the parts should be cleansed with a 1 per cent. carbolic solution or a 1 to 2000 bichloride solution, and the wound treated on general aseptic principles. Restorative treatment will consist in giving codliver-oil, hypophosphites, and last, but not least, food and fresh air.

SPASMODIC LARYNGITIS (CATARRHAL CROUP: SPASMODIC CROUP).

This form of acute catarrhal spasm was first described by Goodhart. The disease is simply an acute catarrhal inflammation associated with a severe spasm of the larynx. Infants under six months of age are rarely affected, and until 5 years the disease is most common. It occurs as frequently in well-nourished as in frail rachitic children.

Catarrhal or spasmodic croup is frequently the result of hypersecretion in the naso-pharynx. When *croup appears suddenly it should not be feared,* especially so if the child was well during the day. It simply results from post-nasal secretions accumulating while the child lies on its back. Such croupous attacks will always yield to a good emetic dose of syrup of ipecac. Such children while awake suffer from the irritation of the secretion and swallow the same by day. A point to remember in this connection is that croup which is fatal or serious comes on *very slowly* and cannot be permanently benefited by giving an emetic.

Symptoms.—The symptoms are similar to those of laryngeal diphtheria. It is at times *very difficult to differentiate catarrhal spasm of the larynx from diphtheritic croup.* It is frequently found in infants with adenoid vegetations and post-nasal catarrh. An inflamed uvula, diseased tonsils, and pharyngeal catarrh are among the contributing factors. The mucous membrane is red and swollen. At first it is dry, but afterward it is covered with a watery mucous secretion. The catarrh may begin in the subglottic portion of the larynx and may be attended by some mucous œdema. It usually follows catarrh of the nose and pharynx, or it may be an extension of the disease from the bronchi.

Children suffering from this form of croup will usually have repeated attacks of the same. The slightest exposure to cold and irritation by dust are among the exciting causes.

After an attack of rhinitis lasting one or more days, the child will suddenly awaken at night with a hoarse, barking cough and the face will be extremely congested. The attack terminates by a long, noisy, high-pitched inspiration.

On inspiration we note deep recession of the suprasternal fossa, the supraclavicular spaces, and the epigastrium. There is also depression of the intercostal spaces and the walls of the chest. The pulse-rate will be greatly accelerated. The temperature rarely rises over 102°. F., although in some instances it may reach 103° F. Owing to the dyspnœa, children will usually gasp and try to sit up. The forehead and sometimes the whole body will be covered with large beads of perspiration after an attack of laryngeal spasm.

Prognosis.—This is invariably good. A point to remember is that when *croup appears suddenly,* it is of a mild type resulting from catarrhal trouble. *The dangerous form of croup comes on very slowly,* and in this type we must always look for diphtheria as a causative factor.

Treatment.—In the treatment of diseases affecting the air passages we aim, roughly speaking, at two things:—

First.—To relieve the cough.

Second.—To cure the disease.

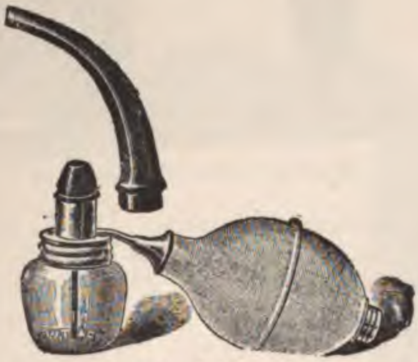

Fig. 135.—Oil Atomizer.

LOCAL TREATMENT.

℞ Menthol	5 parts
Alboline	100 parts

Or:—

℞ Menthol	5 parts
Paroleine	100 parts

Either of the above solutions can be used in the form of a spray every two or three hours. This lubrication soothes the mucous membrane. Guaiacol, 2 per cent. solution, dissolved in alboline, can also be used.

℞ Balsam of Peru	1/2 drachm
Oil of eucalyptus	1/2 drachm

M. Sig.: Dissolve in 2 drachms of alcohol. A teaspoonful into a pint of boiling water, to be used in the form of a spray, by means of a steam atomizer. (Fig. 136.)

When a tubercular condition is suspected, creosote may be added to the steam spray with marked benefit.

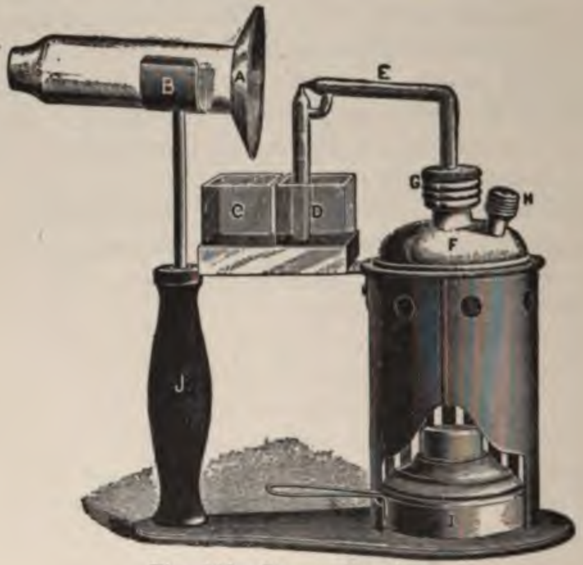

Fig. 136.—Steam Atomizer.

Directions for Using a Steam Atomizer.—Put the liquid to be atomized in the cup D. Fill the boiler F about one-half full of water. Fill the lamp I with alcohol (use nothing but alcohol in the lamp), and after lighting it, place it under the boiler. As soon as the water boils the medicated steam will be thrown out through the tube E, and can be inhaled through the shield A.

Intralaryngeal injections in the treatment of diseases in the bronchi and larynx have been used many years.

As early as 1852 Thompson described a glass and silver syringe for this purpose. The injection was made through the glottis into the cavity of the larynx and not injected under the mucous membrane. This injected fluid passes into the larynx and trachea, and readily enters the larger bronchi.

Local applications of iodine and glycerine are frequently valuable:—

℞ Iodine	3 grains
Glycerine	1 ounce
Kali iodid.	5 grains

M. Sig.: Apply with a cotton swab, on larynx. Once daily.

When this catarrh persists, a single application of the following will frequently abort an acute attack:—

℞ Argenti nitric	10 grains
Aqua destillata	1 ounce

M. Sig.: Apply cautiously over the larynx.

Emetics.—The most rapid method of relieving catarrhal accumulations is in giving an emetic. The choice of the same depends on individual experience. A safe and harmless emetic, quite rapid in action, is a teaspoonful of syrup of ipecac. The same dose may be repeated in half an hour if not effectual. Syr. scillæ comp., commonly known as Cox's hive syrup, in teaspoonful doses, is also a mild drug, producing emesis. Mustard water and sulphate of zinc are also useful. Tartar emetic in $^1/_{10}$-grain doses, gradually increased, is valuable. My favorite emetic is sulphate of copper, 1-grain doses, with $^1/_2$ ounce or less of water. This usually produces an instantaneous effect.

When children are obstinate and will not swallow, a $^1/_{50}$-grain or $^1/_{25}$-grain tablet of apomorphia, given hypodermically, may be repeated in ten or fifteen minutes if necessary. This is a convenient and rapid means of producing emesis. Emesis should not be repeated oftener than once in twenty-four hours, and then always with due regard to the condition of a child.

Inhalations of steam impregnated with turpentine or pine needle-oil have served me very well. For producing this steam a croup kettle or a steam atomizer may be used.

The steam loosens the viscid secretion and can be used every hour or less often, depending on the urgency of the case.

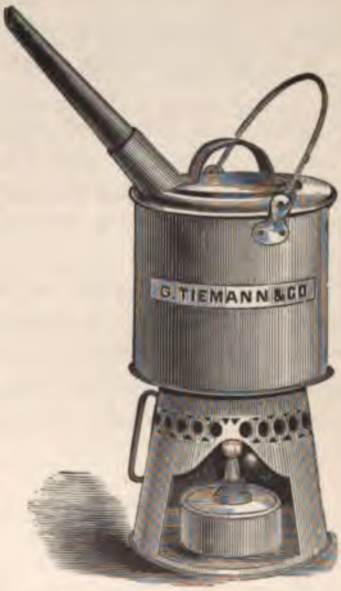
G. TIEMANN & CO.

Fig. 137.—Croup Kettle.

FOREIGN BODIES IN THE LARYNX.

Foreign bodies such as fish-bones or particles of food are occasionally aspirated into the larynx, causing coughing and irritation. In some cases laryngeal stenosis and symptoms of asphyxia result. No time should be lost in commencing treatment, owing to the danger of suffocation.

The hypodermic injection of apomorphia ($^1/_{50}$ grain) until emesis is produced, or syrup of ipecac, several teaspoonfuls given by mouth, will occasionally dislodge the foreign body. If this is not successful a laryngologist should be sent for. A physician who is inexperienced with the larynx should refrain from prolonged attempts to dislodge the foreign body, as in most cases only harm can result therefrom. If asphyxia threatens, tracheotomy should be performed. Those experienced with intubation should first try the effects of the large caliber tube known as the foreign body tube (see chapter on "Intubation").

COUGHS OF REFLEX ORIGIN.

NIGHT COUGH.

A very troublesome form of cough is frequently heard at night. The history given is that the child is quite well during the day, but has a distressing cough at night.

The position of the child on its back permits naso-pharyngeal accumulations to stagnate, hence this cough occurs when the child is on its back. Very young children do not expectorate nor can they clean the nose.

Diagnosis.—A history of cough at night only points to naso-pharyngeal disease. As a rule adenoids and chronic tonsillitis or pharyngitis should be suspected. The absence of fever and the freedom from cough during the day indicates a local catarrh which gravitates when the child is on its back.

Treatment.—If adenoids are present they should be removed. Naso-pharyngeal catarrh should be treated by local applications of $^1/_2$ per cent. of iodine and glycerine solution. The naso-pharynx should be washed by means of a douche every morning and evening. A weak solution of boracic acid or bicarbonate of soda is very serviceable. In persistent catarrh codliver-oil should be given.

SPASMODIC COUGH (PSEUDO-PERTUSSIS).

I have previously described a cough which occurs in children having catarrh of the upper air passages; sometimes this night cough is paroxysmal in character and the spasm resembles whooping-cough.

Cause.—The accumulation of the mucus in the region of the arytænoids and the vocal cords sets up a spasm of the glottis, resulting in attacks of suffocation.

Symptoms.—A hoarse or barking cough, appearing in spasms with an interval of rest, is usually heard. The cough is frequently followed by vomiting. The temperature is rarely above normal.

Diagnosis.—The absence of the cough by day and the appearance of the cough in spasms when the infant is placed on its back, always points to a local throat condition of a non-inflammatory character.

Treatment.—Remove the cause if any is apparent. Locally, astringents are indicated. Restorative treatment, consisting of iron and Fowler's solution, will sometimes permanently benefit the child.

USELESS COUGH.

Thompson and MacCoy, of Philadelphia; Francis Warner, of London, and Emil Mayer, of New York, describe an irritating hacking cough in children. Such children do not suffer with fever, but have a poor appetite, are thin and irritable. Warner studied a series of 22,000 children in schools, and he attributes this condition not to peripheral irritation, intestinal worms, nor to any disease of the tonsils or pharynx, but to unbalanced central nerve action.

REFLEX COUGH.

In post-nasal catarrh we frequently have a profuse discharge which, by irritating the pharynx, causes a cough. This cough frequently resembles that of an acute bronchitis. The examination of the lungs in such cases is usually negative. It is therefore advisable to examine the nose and throat in every case of cough.

CHAPTER II.

DISEASES OF THE BRONCHI, LUNGS, AND PLEURA.

THE LUNGS.[1]

The lungs in children occupy the same position as in adult life. The trachea of the young child is larger in comparison than in the adult; so also the bronchi are larger than in the adult. They occupy more space and are more numerous than in the adult, but the air-cells are much smaller. I have described in detail the method of examination of the thorax in the article on "The Respiration in the New-born Baby."

THE DIAPHRAGM.

The diaphragm occupies a higher position in children than in adults. Dwight studied a series of frozen sections and found the diaphragm in the infant corresponding to the eighth and ninth dorsal vertebræ.

POINTS TO BE NOTED IN THE DIAGNOSIS OF DISEASES OF THE LUNGS.

AUSCULTATION.

Acute catarrhal bronchitis: Sibilant and sonorous râles. Large and small bubbling râles.

Capillary bronchitis: Sibilant, subcrepitant râles.

Asthma: Sibilant, wheezing, sonorous breathing.

Emphysema: Respirations diminished, absent, or prolonged. Low-pitched expiration.

Œdema: Bilateral, subcrepitant râles.

Pneumonia: (1) Crepitant râles; (2) bronchial breathing and bronchophony; (3) broncho-vesicular breathing, crepitant, subcrepitant, and bubbling râles.

Pleurisy: Friction sound with each respiratory act, best heard with inspiration. If the child controls the movements of the lung and keeps the pleural surfaces apart, then no friction sound is heard.

Subacute pleurisy: Friction, absence of vesicular murmur, and vocal resonance.

Fluid and air in pleural sac: Respiratory murmur absent, amphoric breathing above, all sound absent below, splashing râles.

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[1] Acute tuberculosis, tubercular pneumonia, and lobar pneumonia are described in Part VII, in the "Acute Infectious Diseases."

Tuberculosis: **Long, high-pitched expiration, breathing feeble, vocal resonance increased, adventitious râles, later bronchial breathing, bronchophony.**

Tuberculosis, second stage: **Cavernous breathing, amphoric breathing, gurgles, metallic echo.**

PERCUSSION RESONANCE.

Vesicular: Uncomplicated lung.
Dullness: Lung with increased proportion of solids.
Flatness: Solids, fluids.
Tympanitic: Large body of air.
Vesiculo-tympanitic: Lung with increased proportion of air.
Amphoric: Empty cavity with tense walls.
Cracked-pot: Cavity with flaccid walls.

RHYTHM.

Normal rhythm: Regular succession of the respiratory acts.
Interrupted rhythm: Slight deposit in lung.
Divided rhythm: Want of elasticity in lung.
Prolonged expiration: Want of elasticity in lung.

BREATHING.

Vesicular: Uncomplicated lung.
Bronchial: Consolidated lung; compressed lung.
Broncho-vesicular: Moderate consolidation, moderate compression.
Cavernous: Flaccid cavity-walls.
Amphoric: Tense cavity-walls.
Exaggerated: Vicarious respiration.
Diminished: Plastic exudation, want of elasticity.
Absent: Fluid, air.

VOCAL RESONANCE.

Normal: Voice through normal chest.
Bronchophony: Voice through consolidation.
Amphoric: Voice in a cavity.
Ægophony: Voice in compressed lung.
Pectoriloquy: Articulate voice in cavity; in consolidation.
Whispering pectoriloquy: Whispered articulation in cavity; in consolidation.
Cavernous whisper: Ill-defined articulation in cavity.

BRONCHITIS (BRONCHIAL CATARRH, ACUTE BRONCHITIS).

Bronchitis, commonly known as bronchial catarrh, is one of the most frequent diseases of infancy and childhood. It frequently follows nasal catarrh, pharyngeal catarrh, or catarrh extending from the trachea.

Etiology.—There are certain predisposing factors which favor the development of this disease. Children with deficient nutrition, suffering with anæmia, and those with a weakened framework having rickets, are more susceptible to this disease. Children affected with catarrh of the upper air passages frequently invite an extension of this inflammatory process.

Bacteriology.—The pathogenic bacteria found in the bronchi are staphylococci, streptococci, colon bacilli, and diphtheria bacilli. The bacteria most frequently seen are the diplococci of pneumonia and streptococci; in addition to these the bacillus of influenza frequently gives rise to bronchitis. Other germs found were bacillus pyocyaneus and encapsulated bacilli. Ritchie[1] states that the above micro-organisms were rarely found alone, but always associated. He does not believe that a definite germ is the causative agent. These same micro-organisms under different conditions frequently enter the alveoli and produce pneumonia.

Pathology.—The anatomical changes noted in bronchitis are the same, irrespective of the cause. The disease may be limited to the large bronchial tubes or may extend into the finest ramifications. This tendency to extend into the capillaries is greater in children and still more so in infants. The accumulation of the catarrhal products in the smaller tubes adds a gravity of its own to the situation. It is well to emphasize this peculiar tendency of the trouble in those of tender age.[2]

On making a cross-section of the lung a muco-purulent discharge oozes from the bronchi. The same thick purulent matter can be forced out of the smaller tubes when compressing the lung between the fingers. The microscopic examination shows intense congestion of the superficial blood-vessels. Frequently there is a serous infiltration of the bronchial mucous membrane.

When the infection extends into the smallest bronchi it is called "capillary bronchitis." Williams calls it "suffocative," owing to the severe symptoms which develop.

Capillary bronchitis is always accompanied by some alveolar catarrh and frequently passes on to a distinct broncho-pneumonia. Infectious secretions in the larger bronchi are sometimes sucked into the smaller bronchi and frequently cause an inflammation of the lobule. A plug of mucus frequently acts as a valve in a bronchus, permitting some air to escape during expiration and preventing the entrance of air during inspiration.

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[1] Journal of Pathology and Bacteriology, 1900, vii, 1-21.

[2] Christopher: Article on "Bronchitis," "American Text-Book on Diseases of Children."

When all the air is expelled the lobule may collapse. This condition is known as atelectasis pulmonum. This condition is favored when the thorough expansion of the air tubes is interfered with. It is also favored by congestion, thickening of the mucous membrane, and the gummy secretions produced by bronchitis.

It moreover accompanies those cases in which the position is not frequently changed. It is seen in rachitic deformities of the thorax. The most frequent place for this condition is at the border of the lungs. The collapsed area is of a dark red or purple color and shows a unifom red surface on section. It sinks in water, but can be insufflated unless inflammation has already begun (Williams).

Rachford has shown that disease of the lymphatic system is a factor in producing malnutrition in children. In children having the latter condition we must not be surprised if we have a persistent bronchial catarrh baffling the ordinary method of treatment.

Symptoms and Diagnosis.—The symptoms vary with the severity of the disease. In mild cases the temperature rises to about 101° F. at night; in severer cases the temperature will reach 102° F. and even 103° F. The respirations are quickened and labored and the pulse is accelerated. When the temperature is subnormal in rachitic children, then such low temperature should be looked upon as a grave symptom. On auscultation sibilant râles are heard anteriorly, but more prominent posteriorly.

As the secretion from the mucous membrane begins the sibili gives place to loose mucous râles. Graves's point is worth noting, that "the more numerous the sounds heard at any one point to which the stethoscope is applied the smaller the bronchi involved."

Much stress should not be laid on the sputum or the character of the expectoration. Children under 5 years rarely or never expectorate. The pulmonic resonance is usually normal. If the attack is a mild one, as the above-named symptoms would seem to indicate, then the symptoms will subside under palliative treatment. The greatest attention should be bestowed on the pulse.

A pulse-rate between 120 to 130 in a young child should be looked upon favorably. If the pulse is suddenly accelerated and reaches 140 to 160 and the respirations are increased to 60 or 80 per minute, then a broncho-pneumonia should be suspected. Bear in mind that the *normal ratio of respiration to pulse is about 1 to 4;* when this is disturbed so that the ratio is 1 to 2, or even 1 to 3, we should suspect pneumonia.

Prognosis.—This varies according to the severity of the symptoms and the condition of the infant before it was taken sick. Children having a cachectic condition or those having syphilis will certainly have a severer type of infection than children not so affected. In subnormal conditions bronchitis will frequently leave some traces, so that a "chronic bronchitis" is established.

Treatment.—*Hygienic Treatment:* A child with bronchitis must be put to bed in a room having a temperature of 68° to 72° F. The air should be kept free from dust. The room must be properly ventilated. The patient should be given as much sunshine as possible. Dark, ill-ventilated rooms will aggravate this condition. The body should be warmly clad—not too warm. Flannels should be worn next to the skin. A lukewarm sponge bath followed by friction with a coarse towel will stimulate the circulation and is very grateful to the child. If the child has a high temperature then a mustard foot bath should be ordered.

Dietetic Treatment.—If the child takes a large amount of nourishment and assimilates the same, then the chances of restoring health are excellent. To rely on drugs and exclude food is to discard the most important part of the treatment. When the child refuses food by mouth, then rectal feeding should be resorted to, so that the body is sufficiently nourished. It is a good plan to predigest milk for feeble infants, hence peptonized milk or whey and soups and broths should not be forgotten. The yolk of an egg beaten up with sherry wine for a child several years old will be found a convenient method for giving nourishment with stimulation. Water is very important in the treatment of this disease, especially so when there is a large amount of expectoration.

Medicinal Treatment.—If the temperature is over 102° F., 1-drop doses of tincture of aconite, given every two hours, will be useful to reduce the fever. All children who cough swallow their mucus, hence a laxative or an emetic will be very serviceable. A teaspoonful of castor-oil, repeated in six hours, is very valuable. As an emetic a teaspoonful of syrup of ipecac, repeated in fifteen or twenty minutes if necessary, can be tried. When rapid emesis is desired, 1 grain of sulphate of copper dissolved in a teaspoonful of water will be very effective. This dose should not be repeated more than once in two or three hours. Apomorphin in doses of $^1/_{100}$ grain, hypodermically, is a very effective emetic. This is indicated when the child refuses to take medicine.

When the secretion is very viscid then steam inhalations will be very serviceable. The steam atomizer will be found very valuable in young children who cannot be held over moist vapor. Steam impregnated with beechwood creosote will be found not only a valuable means of loosening adherent mucus, but it has a decided therapeutic effect. It is a powerful antiseptic.

Restorative Treatment.—Restorative treatment, such as using an emulsion of codliver-oil or a malt extract, with or without iron, should not be omitted.

BRONCHIAL ASTHMA.

This is frequently called spasmodic asthma, owing to the spasmodic or paroxysmal dyspnœa associated with wheezing respiration. A peculiarity of this condition is that children appear to be perfectly well during the intervals.

Etiology.—Children having neurotic tendencies or those children of gouty families seem to be predisposed to this affection. Most writers on this subject believe that this condition is a vasomotor neurosis resulting from disturbed innervation of the pneumo-gastric or its ramifications, or the vasomotor nerves, causing a spasm of the muscles of the air passages. Hay fever is an affection which closely resembles bronchial asthma and alternates with it.

Exciting causes are many; for example, enlarged bronchial glands, enlarged tonsils, adenoids, elongated uvula, and hypertrophied turbinates. The inhalation of irritants, such as dust, may irritate and provoke a spasm. Not infrequently we find eczema existing at the same time or alternating with attacks of asthma.

Gastro-intestinal disturbances are among the most frequent causes of asthmatic attacks.

Pathology.—This is not known. Talma says: "The attacks are due to a spasm of the larynx, rarely to a spasm of the constrictors of the glottis, and that it is partly under voluntary control." Various theories are offered. One, that the attack is due to a swelling of the bronchial mucous membrane or to a catarrh of the bronchioles, or possibly to a spasm of the bronchial muscles.

Symptoms.—Without warning, a spasm or shortening of breath comes on, most frequently at night. There is usually such oppression and distressed breathing that the child must sit up. Frequently the distress is so great that the child will grasp any object within reach. The shoulders are elevated and the head thrown back so that the accessory muscles of respiration are brought into play. The face assumes an anxious expression, and later becomes cyanotic. The eyes are prominent and the alæ nasi widely dilated. A cold, clammy perspiration is usually present. The respiration is loud and wheezing. The respirations are rarely increased in number. The inspiration is jerky, the expiration prolonged and laborious. There is very little or no thoracic expansion. The pulse is small and rapid. There is no fever, but we frequently have a subnormal temperature when the attack is prolonged. The extremities are frequently cold. After the attack there is exhaustion followed by sleep. An attack may last several hours, sometimes days. Percussion of the chest during the paroxysm shows *hyperresonance*. There may be either diminution or prolongation of the vesicular murmur. The whole chest has sibilant and sonorous râles and wheezing sounds.

The diagnosis is easy; we must exclude spasm of the glottis, croup, tracheal stenosis, and neoplasm in the larynx. The absence of fever will easily differentiate this condition from inflammatory respiratory diseases.

The prognosis is usually good, especially so at the time of puberty. After an attack a careful examination of the lungs, the kidneys, the nose, and the throat should be made, and the exciting cause, if possible, should be noted.

Treatment.—During the paroxysm stramonium leaves can be ignited with some alcohol and the fumes inhaled. Inhalation of the fumes of saltpeter paper is very good. The inhalation of chloroform offers very quick relief, so does nitrite of amyl or ethyl chloride. Opium in the form of Dover's powder or small doses of morphine or codeine are the best remedies. Chloral hydrate with or without bromide of potassium is very valuable. Belladonna is also useful. During the interval iodide of sodium in full doses may be given. A child suffering with asthma should be put to bed in a quiet room with *plenty of fresh air.* A dose of calomel or citrate of magnesia, or 5 or 10-grain doses of phosphate of sodium, should be given to cleanse the stomach and bowels. Relief is frequently afforded by giving a very high colon flushing and washing away as much fæces as possible. The stomach should be carefully guarded, and liquid, concentrated food rather than bulky food, should be given. In other words distention of the stomach with pressure on the diaphragm will frequently cause a severe attack. The kidneys should be kept active and stimulated by giving 10 or 15-drop doses of sweet spirits of niter occasionally.

BRONCHO-PNEUMONIA (CATARRHAL PNEUMONIA OR LOBULAR PNEUMONIA).

This disease derives its name from the fact that it usually exists as an inflammatory condition affecting small areas of the alveoli of the lung. Contrary to lobar pneumonia, this catarrhal form does not terminate by a distinct crisis. This disease is usually a sequela to or a complication of whooping-cough, measles, diphtheria, or typhoid fever. It is this form which is most dreaded in diphtheria and which rarely ends favorably. It does not occur in distinct cycles nor does it run a distinct course. One child may suffer with a broncho-pneumonia extending over ten days or two weeks. Another child with the same form and severity of the disease may suffer from eight to ten weeks. Thus this disease may be considered to be of a distinct wandering type. This disease does not depend on seasonal changes, although the greatest number of cases are met with in the spring and fall. Infants and nurslings as well as older children seem to be equally affected.

Etiology.—By far the greatest number of catarrhal pneumonias may be found in those children offering the least resistance. Such cases are usually found in scrofulous, tuberculous, rachitic, and syphilitic children. When children have previously suffered from infections such as diphtheria, scarlet fever, measles, or typhoid fever, they are peculiarly predisposed to this secondary infection. It is for this latter reason that this disease is so fatal. In a series of fatal cases accompanying the various types of diphtheria seen by me at the Willard Parker Hospital, the large bulk succumbed to this complication. This is due in a great measure to the devitalized condition of the body after a toxæmic infection, such as is found in diphtheria. Whether or not this disease is contagious has not been definitely settled.

Bacteriology.—We know that various forms of germs, such as the staphylococcus, streptococcus, the diplococcus pneumonia (Friedlander), the diplococcus (Fraenkel), and bacterium coli, are among the specific micro-organisms which have been found intimately associated with this disease.

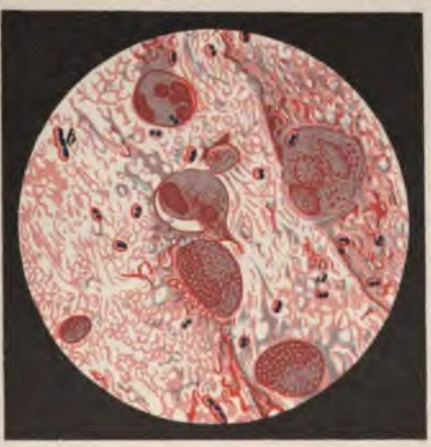


Fig. 138.—Diplococcus Pneumoniæ (Pneumococcus): (*a*) single diplococci; (*b*) the same in chains (Wolf's double stain). Leitz ocular I, oil immersion $^1/_{12}$. (Lenhartz-Brooks.)

Pathological Anatomy.—The tracheal and bronchial mucous membrane is intensely congested, and the lumen of the smaller bronchi filled with thick muco-pus, which adheres to the surfaces and is as tenacious as a pseudo-membrane. The lung at the seat of infection shows dark brown or brownish-red, infiltrated areas, sometimes of a bluish-red color. The surface of the pleura contains large or small hæmorrhagic areas. They resemble a sort of hepatization, brownish, grayish, or yellowish-gray in color, and in some areas have purulent infiltrations. Sometimes the interstitial tissue is associated in this condition with a tendency toward cicatricial formation. Sometimes the alveoli have an emphysematous distention. The whole process seems to be a bronchiolitis associated with cir-

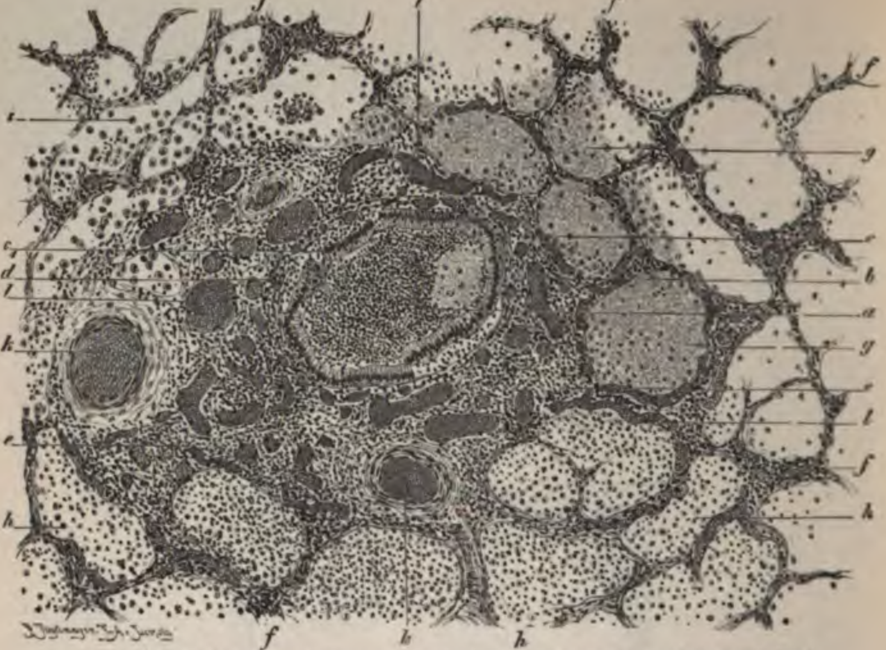
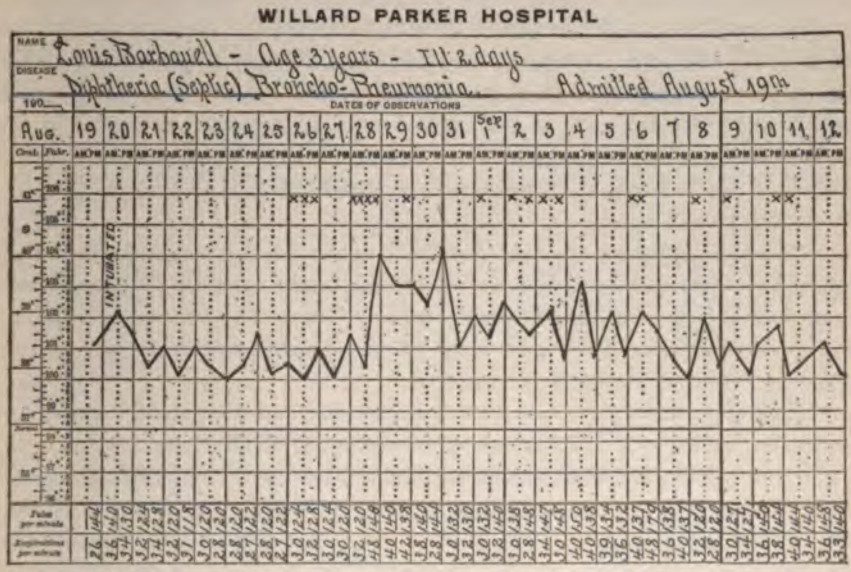


Fig. 139.—Purulent (Suppurative) Bronchitis, Peribronchitis and Peribronchial Broncho-pneumonia in a Child Fifteen Months Old. (*a*) Purulent; (*b*) mucoid bronchial contents; (c, c^1) bronchial epithelium infiltrated with round cells and partly desquamated (c^1); (*d*) bronchial wall containing strongly congested blood-vessels and infiltrated with cells; (*e*) cellular infiltrated peribronchial and periarterial connective tissue; (*f*) septum between the lung alveoli, partly infiltrated with cells; (*g*) fibrinous exudate in the alveoli; (*h*) alveoli filled with richly cellular, (*i*) with poorly cellular exudate; (*k*) transverse section of pulmonary arteries; (*l*) strongly congested bronchial, peribronchial and intra-acinous vessels. X 45. (Ziegler.)

cumscribed atelectasis of the lung, from which hyperæmia and infiltrations of tissue result.

Symptoms.—The symptoms are those of a bronchial catarrh and a bronchitis. Associated with this there is the usual fever, restlessness, and an increased frequency of respiration; there is also dyspnœa. There is a distinct cyanosis affecting not only the face and lips, but frequently the nails. There is an anxious expression to the countenance. The alæ nasi participate in the respiration. The whole respiration seems to be superficial and brings every muscle into action. That there is an obstruction can easily be seen by an observation of the jugulum, by noticing the intercostal space and also the epigastrium, which sinks at each inspiration. The frequency of respiration will sometimes be increased to 70 or 80 per minute, and it is very jerky in character. The pulse-rate will suddenly rise to 140 or 160, and frequently in some cases to 200 per minute. The temperature may be as low as 100° F. and gradually rise one degree or more each day. It may reach 104° or 105° F. in the evening. The temperature usually shows a morning remission of at least one or two and sometimes three degrees.

Pictorial illustrations of broncho-pneumonia complicating measles and diphtheria will be found in their respective chapters.



× Reintubated.

Fig. 140.—Louis B. Age 3 years. This very instructive case illustrates the tolerance of the larynx for the intubation tube. In all twenty intubations were performed. The chart illustrates the tube coughed up four times in one day, thus requiring four distinct intubations in twenty-four hours. In spite of the fact that the case was septic from the beginning, and that the child had a broncho-pneumonia, the case recovered. In order to retain the tube and prevent its being coughed up, the caliber was gradually increased from a number three until an eleven to twelve tube was used. (Original.)

Physical Examination.—The physical examination of the thorax shows moist râles, sibilant or sonorous râles, or coarse mucous râles, at times distinct bronchial breathing accompanied by a metallic sound. Percussion will usually show dullness over small areas. While this may be due to the localized area of consolidation, it is quite possible that the dullness may also be attributed to enlarged bronchial glands in this region. When the dullness terminates favorably the temperature falls, the pulse assumes a more regular character, the heart sounds, which formerly were feeble, appear louder, stronger, and rhythmic. The cough will be more frequent, the respiration less frequent and not so superficial. Children who formerly were apathetic now appear to notice everything, and appear very sensitive on being handled, and especially so during an examination. The physical signs of a diffused bronchitis and the diffused areas of moist râles associated with the localized areas of bronchial breathing disappear. The bronchial breathing which existed before now becomes vesicular in character. The pulse, which formerly was greatly accelerated, and the respiration, which was very frequent, now both return to their normal state. The whole character of this affection has no specific rule, but drags along without a distinct termination, differing from that condition so well known and described as croupous pneumonia. It is not rare to note an apparent cessation of the inflammatory condition in the pulse, respiration, and temperature, and to find that new inflammation has begun with more active symptoms than has been just passed through.

We can therefore see that a broncho-pneumonia frequently is a continuance of an inflammation which spreads from portion to portion and from lobe to lobe, and thus devitalizes the system. The symptoms affecting the gastro-intestinal tract and those of the genito-urinary organs are the same as found in croupous pneumonia.

The differential diagnosis between catarrhal and fibrous pneumonia can easily be made by a comparison of the course which these diseases run. Catarrhal pneumonia commences with symptoms of a bronchial catarrh or a bronchitis. These same symptoms remain during the course of the disease. The symptoms do not have those of an acute character which characterize croupous pneumonia, but rather assume a chronic appearance. The great danger consists in the development of pus infiltration in the lungs, and it is only by the rapid emaciation that symptoms of *miliary tuberculosis* can be suspected.

We can differentiate catarrhal pneumonia from atalectasis by the total absence of fever in atalectic conditions.

Prognosis and Course.—The prognosis depends on the origin of this disease. If, for example, broncho-pneumonia is a sequela to measles, diphtheria, whooping-cough, scarlet fever, or typhoid, and the child has passed through a severe infection in which the corpuscular elements of the blood have greatly suffered, then the prognosis is grave. If, on the other hand, this disease commences as a primary affection and the child is in a fairly well-nourished condition, then the prognosis is good. The prognosis will chiefly depend on the amount of food that can be properly assimilated and the care with which the case is nursed. The course is slow and tedious, and may develop tubercular pneumonia.

The hygiene is very important in this condition. The prognosis of catarrhal pneumonia following whooping-cough, measles, or diphtheria will usually show that almost 70 per cent. of cases so affected are fatal.

Treatment.—If the temperature is high, antipyretic remedies, such as the coal-tar products, are not indicated, owing to their well-known de-

pressing effect upon the heart. The author has never used them without seeing an ill effect. When they are used they should be combined with camphor or musk to counteract this well-known depression. The safest antipyretic measure in pulmonic affections is undoubtedly hydrotherapy. A cold compress applied over the thorax and repeated once every half-hour, not only acts as an antipyretic, but will stimulate the respiratory muscles and provoke deep inspirations. This will distend the smaller portions of the alveoli and will prevent atalectasis pulmonum. If there is very great

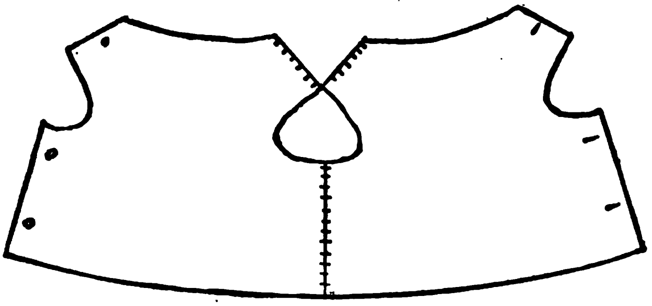


Fig. 141.—Diagram for Pneumonia Jacket Opened at Side.

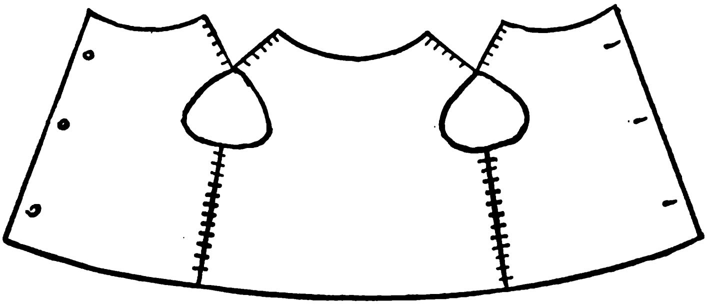


Fig. 142.—Diagram for Pneumonia Jacket Opened in Front. **(Original.)**

dyspnœa owing to the presence of viscid secretions, then an emetic is indicated. One of our best emetics is sulphate of copper in 1-grain doses, repeated in an hour if necessary. Another emetic and one which is less irritating than the above is syr. scillæ comp. in ½ to 1 teaspoonful doses, repeated every half-hour until the desired effect is produced. Syrup of ipecac in doses of one teaspoonful, repeated every fifteen to twenty minutes, is also serviceable. When a child has extreme dyspnœa and it is not wise to administer an emetic by mouth, then a hypodermic injection of $^1/_{20}$ grain of apomorphia dissolved in five or ten minims of sterile water injected deeply into the subcutaneous cellular tissue, will usually provoke emesis. If this dose is not effectual in fifteen or twenty minutes, then another dose of apomorphia may be given. Tartar emetic in doses of $^1/_{10}$ grain, in sweetened water, may be given every hour until vomiting is produced. It is better not to change from one drug to another unless several doses have proven ineffectual.

Flaxseed poultices are sometimes recommended when the secretions are very viscid. These have frequently proven efficacious in the hands of the author. In urgent dyspnœa great relief can be afforded by the application of dry cups over the affected areas of the lungs.

A pneumonia jacket consisting of cheese cloth, which is worn next to the skin, then a layer of cotton wool, and the whole covered with oiled silk or oiled muslin, will serve to prevent chilling of the surface. Figs. 141 and 142 show diagrams of these jackets.

Internal diffusible stimulations, such as $^1/_2$-grain doses of carbonate of ammonia, repeated every hour, are serviceable. Liq. ammon. anisati, in doses of from 3 to 10 drops, repeated every hour, is one of our best diffusible stimulants. If symptoms of collapse appear then active alcoholic stimulation must be resorted to, such, for example, as champagne, brandy, whisky, or wine *ad libitum*. In addition thereto, a sinapism over the front and back of the chest and mustard foot baths may be required. Hypodermic medication will frequently be found necessary, especially if the heart's action is feeble. One two-hundredth of a grain of nitro-glycerine injected hypodermically or caffeine citrate will sometimes work well. Strychnine sulphate in doses of $^1/_{200}$ grain, gradually increased, repeated every three or four hours or oftener, will stimulate the heart's action. An excellent heart stimulant is to give 1 drop of tincture of musk every hour.

If the cough is very troublesome, especially at night, and the child is in a fair physical condition, then codeine in doses of $^1/_{20}$ to $^1/_{10}$ grain for a child 1 year old, repeated every two or three hours, will relieve. Dionin is a remedy that has been used by the writer with considerable success in the treatment of various forms of cough in doses of $^1/_{20}$ grain, repeated every three or four hours, for a child 1 year old.

Stimulating expectorants such as syrup of senega, in doses of from 10 to 15 minims, may be advantageous. The vital point to remember is to support the system with nourishment. If the child will not take food per mouth, then rectal feeding consisting of nutrient enemas is demanded.

Water should be given freely during the course of a broncho-pneumonia to stimulate the action of the kidneys.

PULMONARY GANGRENE.

This condition, fortunately, is very rare.

Diagnosis.—This is made by the characteristic foul odor of the breath and the expectorated gangrenous material. I have seen a case of this kind during my summer service at the Willard Parker Hospital in a child that suffered with laryngeal diphtheria complicated by broncho-pneumonia. The septic condition dragged on for weeks. There was a very putrid odor to the breath. The child finally died of sepsis. As a rule the diagnosis can only be made post-mortem.

Treatment.—Restorative treatment, consisting of light nutritious diet, should be given and stimulants liberally used. Steam inhalations impregnated with beechwood creosote will modify the odor. Creosote carbonate can be given with the food in 5 to 10-minim doses, several times a day.

PLEURISY.

An inflammation of the pleura is by no means rare in children. It is found very frequently post-mortem, although no evidence of the same existed *intra vitam*. It may be a primary condition.

There are two distinct forms of pleurisy usually seen: 1. Pleuritis sicca (dry pleurisy). 2. Pleuritis exudativa. The latter form can again be divided into *(a)* serous, *(b)* sero-purulent, *(c)* purulent, *(d)* hæmorrhagic.

The last mentioned is a rare condition. It is seen in traumatic conditions, in hæmophilia, and occasionally when tuberculosis is present.

DRY PLEURISY.

This form of pleurisy usually follows an exposure to cold, although it may follow as a secondary inflammation to the lung. There is usually an exudation of fibrin only.

Pathology.—The pleura is swollen and thickened, and there is an exudation of fibrin. Adhesions frequently result from these bands of fibrin between the opposite pleural surfaces. The pleura loses its natural lustre. When the process ceases and the lymph is absorbed, the condition is called "dry pleurisy." The fibrinous bands between the pleura costalis and pulmonalis usually leave permanent adhesions.

Symptoms.—The disease is usually ushered in with high fever which may reach 104° or 105° F. Cough is usually present. It is a short, hacking, irritating cough. It is accompanied with pain. As a rule children cry during each coughing paroxysm. There is no expectoration. A friction sound or a fine crepitant râle is heard over the affected area. There is

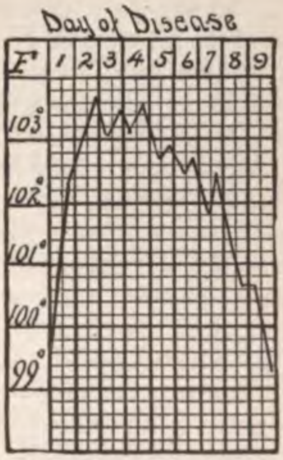


Fig. 143.—Fever Curve in a Case of Dry Pleurisy. (Original.)

vesicular breathing. The percussion is rarely abnormal. The tongue is usually coated. The bowels are constipated. The urine is scanty. The surface of the body is dry and warm. There is usually a gradual increasing dyspnœa. The pulse-rate is increased, so also are the respirations. The symptoms resemble those of a pneumonia and can rarely be differentiated without a careful physical examination. There is usually pain on percussion over the affected area. The children do not wish to be handled, but prefer to lie quietly.

The diagnosis depends on the symptoms above described We must bear in mind the frequency with which pulmonary complications are associated.

The prognosis is usually good, although adhesions frequently remain.

Treatment.--Counter-irritation, such as cupping of the chest, the application of iodine over the affected area, or painting with cantharidal collodion, acts well. Strapping the chest with broad straps of adhesive plaster or the application of a very tight-fitting bandage, seems to support the chest and relieve the cough Calomel is indicated especially if constipation accompanies this condition. Iodide of sodium with very small doses of codeine may be given at regular intervals to relieve pain. A full dose of codeine or morphine may be given at night if the cough is distressing or the pain acute. I have given from $^1/_{30}$ to $^1/_{20}$ grain of morphine hypodermically to a child 2 years old to relieve a severe cough.

PLEURISY WITH EFFUSION (PLEURITIS EXUDATIVA).

This secondary form of pleurisy is usually a complication or an extension of the infection in pneumonia. It is frequently met with in influenza and in infectious diseases. I have frequently seen pleurisy with effusion in the scarlet fever wards of the Riverside Hospital. I have also seen pleurisy complicating tuberculosis and rheumatism in children.

Bacteriology.—In some cases the streptococcus, in others the staphylococcus, is present. A diplococcus has also been found and believed by some to be the cause of pleuritis. The pneumococcus has been found present, so that it is difficult to state which pathogenic microbe is the true cause of this condition. Whether this microbe gains entrance to the pleura from the lung by inhalation or through the skin, or whether the tonsil is the means of entrance of the pathogenic bacteria, causing this disease, has not been definitely determined. We know that suppuration in other parts of the body, as, for example, in the abdomen or in the spine, can frequently carry microbic elements to the pleura and thus directly transmit the infection. Pyogenic bacteria may be carried to the pleura through the lymph channels and by the circulation.

Pathology.—This form of exudative pleurisy is the one most frequently encountered. We rarely find both sides involved, although a double pleurisy is by no means rare. The pathological condition is practically the same as described in the chapter on "Dry Pleurisy." In this condition we have more or less serous effusion. The serum may be clear, it may be bloody, or it may be turbid. Serous effusions found in a healthy child are usually absorbed. Adhesions are frequently left in this form of pleurisy.

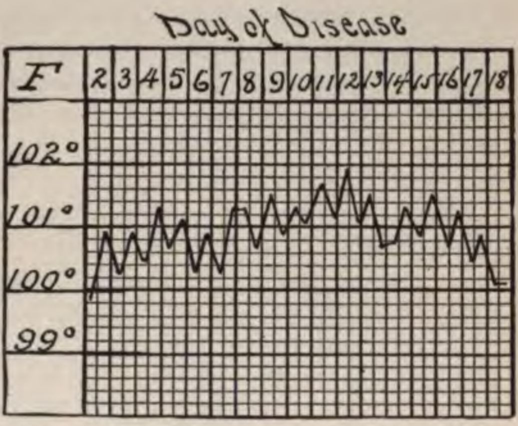


Fig. 144.—Fever Curve in a Case of Pleurisy with Effusion. (Original.)

Symptoms.—The fever may be high or low. Fever and general malaise accompanied by a hacking cough will frequently be the only symptoms. I have frequently seen children brought to my clinic with the history of *a cough, no expectoration,* anorexia, with general weakness and emaciation, in whom a pleurisy with a large effusion was detected.

Diagnosis.—The diagnosis in very young children is at times difficult. It can only be made by a most careful physical examination of the chest.

Physical Signs.—Before the effusion is marked and during its absorption friction sounds are heard over the inflamed area. *After the effusion* is present there are no friction sounds. There is an absence of râles, distant bronchial breathing and *flatness* on percussion. There is diminished breathing, so that the voice or the cry of the child will appear very distant. At the level of the fluid the voice has a tremulous sound, known as *ægophony.* There is a bulging of the intercostal spaces. The breathing is bronchial or tubular. Not infrequently the heart is displaced. A careful inspection of the chest will show that there is a loss of motion on the affected side during respiration.

In some cases the diagnosis depends on the result of an exploratory puncture with a clean (aseptic) needle having a large caliber. One of the best needles for this purpose is one similar to that used for the injection of antitoxin. A puncture should be made after washing the skin with soap and water followed by alcohol or ether. The needle is then inserted about one inch. Sometimes it is necessary to make several exploratory punctures in order to find the liquid, especially so in the encapsulated form of pleurisy, where a small area is involved. After withdrawing the liquid the character of the same should be determined by examining it under the microscope. If pus corpuscles are found we should insist on an operation, as no other treatment will be satisfactory. Not infrequently a serous effusion will be absorbed by the exploratory puncture, so that the puncture is at times a very valuable therapeutic adjunct.

Treatment.—Firm strapping of the chest with bands of adhesive plaster is useful; 5 to 15-grain doses of iodide of sodium, according to age, may be administered three times a day in milk, soup, or broth. Fresh air should be constantly permitted. If pain is absent then gentle but long inspirations and expirations (pulmonary gymnastics) are worth trying. By properly exercising the lungs we can stimulate nutrition to the parts and frequently assist in the absorption of an effusion.

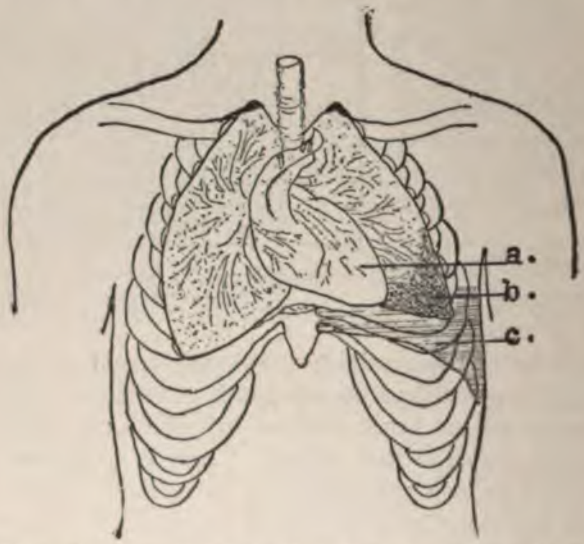


Fig. 145.—Diagrammatic Illustration of Heart and Lungs in a Left-sided Pleuritic Effusion. a. Heart. b. Compressed lung, area of bronchial breathing and crepitant râles. c. Effusion. (Original.)

Dietetic Treatment.—No matter what form of treatment is instituted, nothing will avail so much as proper feeding. The dairy products—milk, eggs, and cheese—in conjunction with cereals and fruits, should form the bulk of the food ordered. Concentrated soups and broths are also useful.

EMPYEMA (PURULENT PLEURISY).

Etiology.—As a rule we find this disease following pneumonia or pleurisy. It is a favorite complication of the infectious diseases, so that after a pneumonia in an acute infectious disease we must not be surprised to find an empyema.

Bacteriology.—The bacteria most frequently found are the streptococcus, the staphylococcus, and the pneumococcus. Rarely has the tubercle bacillus been found.

Pathology.—The surface of the pleura is covered with fibrin and pus and the cavity filled with a purulent exudate, the result of this inflammation. The pus settles to the bottom of the pleural sac.

Not infrequently both pleuræ become involved, although the rule is to find but one pleura or part of it affected. When not treated the pus may rupture into the lung or burrow externally through an intercostal space.

Symptoms.—*The most pronounced symptoms are flatness on percussion and diminished respiratory sounds. Sometimes they are totally absent. There is also a loss of the vocal fremitus. At the level of the fluid the voice has a tremulous quality known as ægophony.*

Above the fluid the breathing is broncho-vesicular due to the compressed lung. Pleurothotonos is sometimes seen.

There is an absence of expansion of the chest on the affected side. When this condition exists on the left side it may displace the heart.

I rely upon the examination of the blood, in addition to the physical signs given, as an important guide in determining the presence of pus in the system. See article and illustration of "Blood Reaction of Pus," in the chapter on "Blood."

Diagnosis.—If the fever continues after a case of pneumonia, or pain in the chest persists accompanied by dypsnœa, cough, and sweats, then empyema should be suspected.

When the disease progresses the temperature frequently returns to normal or nearly so. The child shows symptoms of general exhaustion, emaciation, and is extremely anæmic. Diarrhœa is a frequent symptom in this condition.

The physical signs above noted are usually positive. When there is any doubt, and in order to confirm the symptoms pointing to an empyema, an exploratory puncture should be made.

If the needle is sterile and sharp and the surface to be punctured is rendered aseptic, then there is no risk in making one or more punctures to aid in establishing the diagnosis.

Choice as to Where the Needle is to be Introduced.—My plan has always been to find by percussion the area having the greatest dullness or flatness, and insert the needle after noting the following:—

Points to be Noted while Making an Exploratory Puncture.—The skin should be washed with soap and water, dried, and again washed with alcohol, and lastly with ether. The needle should be boiled about five minutes before being used.

If the needle is introduced on the right side, due allowance must be made for dullness in the region occupied by the liver. Do not introduce the needle too near the region of the spine, but choose rather an intercostal space in the axillary line or preferably below the scapula on either side. If the needle is introduced on the left side do not push it too forcibly nor too deeply or hæmorrhage may result. Sometimes the fluid is fibrinous and will not readily enter the caliber of the needle. If the needle is plunged too far and enters a dilated bronchus, due allowance must be made for a purulent secretion which should not be mistaken for empyema.

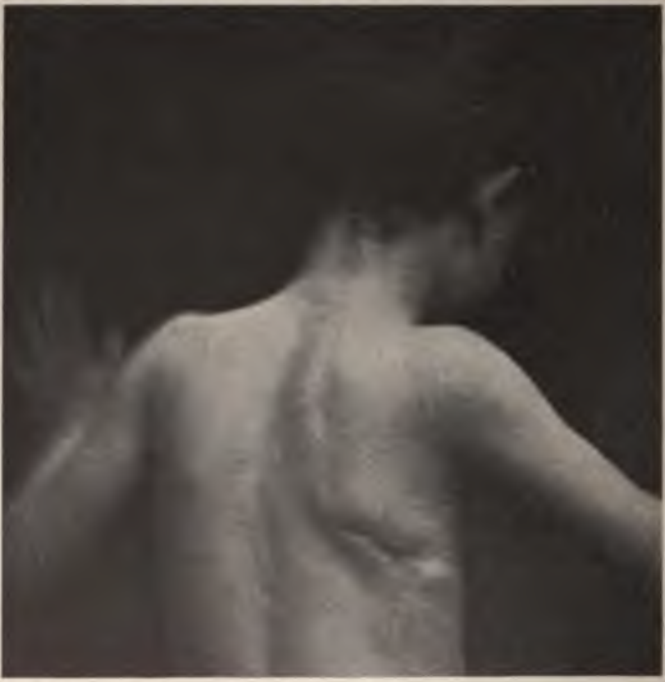


Fig. 146.—Illustrating a Severe Localized, Right-sided Empyema. Two ribs were resected. The child made a complete recovery. The thorax shows very slight deformity after the operation. (Original.)

Prognosis.—This depends upon the general condition at the time of the operation. If the tubercle bacillus is found in the pus the prognosis is bad. The longer the disease existed the more doubtful the prognosis. If the condition is a sequela to a pneumonia or a pleurisy then the prognosis is good.

Course.—The tendency of empyema in a child is to recovery. Out of 20 cases operated by me, 18 recovered in four to five weeks. One case recovered after six months of continued surgical treatment, and was operated three times. One case was ill over two years, tubercle bacilli being found. This case belonged to the tuberculous type of empyema.

Surgical Treatment.—When pus is located, the indication is to remove it. An incision should be made at least two inches long through the skin, and parallel with the rib. If the pus is thin in character a simple intercostal incision carried into the pleura will evacuate the same. If the pus contains fibrinous coagula, it is better to resect one or two ribs. Care must be taken to preserve the periosteum in resecting the ribs. By this latter method we have complete drainage, and if the case is treated on general aseptic principles with drainage, gauze, and restorative treatment, the outcome is usually good.

Points to be noted in empyema cases:—

1. *Anæsthetic.*—Do not use general anæsthesia if cyanosis, marked dyspnœa, or other severe toxic symptoms are present.

Local anæsthesia, such as chloride of ethyl or cocaine, can be used. I have frequently operated with the aid of chloride of ethyl.

2. *Regarding Antisepsis.*—When pus is located we must resort to the usual details of asepsis and antisepsis. The instruments should be rendered thoroughly aseptic and the child should be given a bath on the day of operation in addition to a thorough scrubbing of the seat of operation.

The physician, if a general practitioner, should be extremely careful and not operate if he has been in contact with an acute infectious case; neither should he operate if he has a case of erysipelas or diphtheria under his care.

While the pus is being evacuated, turn the child from side to side, to empty the pleural cavity. If the heart's action is poor this should not be done.

A large-sized drainage tube should be inserted into the wound. The pleural cavity should not be washed with any fluid. Some authors advise using warm salt solutions. It is important to have a cross-section of rubber tube or a large safety pin attached to the drainage tube, otherwise, as has already happened, the tube may be lost in the cavity.

The following case will illustrate peculiar symptoms shown in some cases of empyema:—

A male child, 4 years old, was brought to my office by Dr. M. Freid, with the following clinical history: The child's appetite is poor. He does not sleep well, and has a peculiar waddling gait. The left shoulder blade protrudes so that a decided deformity is noticeable. There was no further history.

An examination of the child showed marked emaciation. Temperature 100 $^{4}/_{5}$° F., pulse 120, respiration 38, breathing labored, heart sounds weak but clear. On percussion there was marked dullness and flatness over the central and upper lobe of the lung on the left side. An exploratory puncture made about the eighth intercostal space showed pus. Owing to the weakened state of the child it was necessary to operate without an anæsthetic. Ethyl chloride was used, an incision made, and two ribs resected. Thorough drainage was maintained with the aid of a drainage tube, and with the addition of restorative treatment, the case made an uneventful recovery.

Treatment.—The treatment consists in building up the system with tonics of iron, hypophosphites, codliver-oil, malt, sea-salt bathing, and fresh air, in addition to a nutritious diet, of which milk, eggs, and cereals should form the bulk.

Stimulation will be urgently required. In other words, our aim should be to build up the body to withstand the shock of the operation, and at the same time to nourish and restore the general weakened condition.

After-treatment.—Strict asepsis. Change dressings daily. Use clean drainage tube and fresh gauze. Remember the danger of iodoform poisoning in using large strips of iodoform gauze.

Give nutritious food. Sometimes a change of air to the mountains or seashore will aid in recovery.

Remember that 10 per cent. of all cases in which a simple incision is made do not require after-treatment. Ninety per cent. of cases require resection of the ribs and frequently additional surgical treatment for chronic empyema.

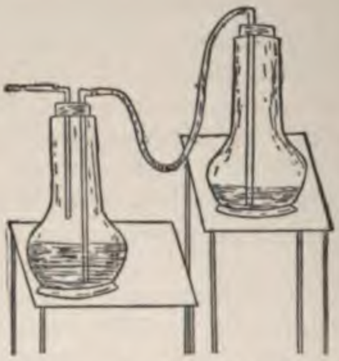


Fig. 147.—James Apparatus for Expanding the Lungs in Empyema.

James Apparatus.—Pulmonary gymnastics, such as inspiration and expiration, should be frequently practiced to aid in the expansion of the lung after an operation for empyema. A clever device is known as the James apparatus, by which a colored liquid can be blown from one bottle into another. This may be given to the child as a toy, and is very valuable as a means of producing deep inspiration and expiration.

CHRONIC EMPYEMA.

Neglected cases or those of long standing frequently require additional treatment. Adhesions will frequently form preventing the normal expansion of the lung. A small opening or sinus containing exuberant granulations will be seen. In some cases seen by me pus has oozed for months. In a case of this kind nothing will do as well as a radical operation such as

Estlander recommended (thoracoplasty). The adhesions must be broken up and thorough drainage allowed. When such a radical operation is performed, deformity usually follows. These cases belong to the surgeon.

TUBERCULAR EMPYEMA.

This condition while rare has been seen by me twice during the last five years. It is found in families where tuberculosis exists. We must bear in mind that a tubercular empyema may be the complication of what was formerly a non-tubercular type.

Environment and heredity play an important part in the etiology of this condition. Just as a tuberculosis may follow the broncho-pneumonia of measles, so I believe that tubercular empyema may also develop. The following case will illustrate this condition as seen by me in consultation in New York City:—

M. J., 5 years old, was referred to me by Dr. Mehrenlander, with a history of cough, fever, and emaciation. The diagnosis of empyema was made and an exploratory puncture showed the presence of pus. With the assistance of Dr. Mehrenlander I performed a thoracotomy. As there were thick croupous masses, two ribs were resected and a drainage tube inserted. In this case the wound discharged several months and an examination of the pus showed the presence of tubercle bacilli. With the aid of fresh air and restoratives, such as codliver-oil, creosote carbonate, and special attention to the out-door life, the child recovered.

Family History.—The child's father and mother are living. Their occupation is janitor and janitress in a tenement house. They receive in compensation for services free rent, so that gives them very unsanitary surroundings. The bedrooms are dark and very unsanitary. An older brother, 17 years of age, has acute apical tuberculosis. This older brother when brought to me for a slight cough showed no visible evidence of disease, in fact he appeared well nourished. His sputum contained tubercle bacilli. We therefore have in the two cases just described a tubercular empyema associated with family tuberculosis. The coexistence of empyema and a family history of tuberculosis strengthened my opinion, that living under the same unsanitary conditions and associating together, these cases were most probably transmitted or communicated.

PART VII.

THE INFECTIOUS DISEASES.

CHAPTER I.

FEVER.[1]

This is a pathological process generally caused by the poisonous products of bacteria, and characterized by a rise of temperature above the limit of the daily variation. It is further associated with an increase in the frequency of the heart and the respiratory movements, often with an increase in excretion of urea and ammonia in the urine and a diminution in the alkalies and CO_2 in the blood.[2]

Some authors state that the cause of fever is the action of bacterial poison or of other substances on the heat centers, and that antipyretics or drugs which reduce the temperature in fever, do so by restoring the centers to their normal state by preventing the development of the poisons, aiding their elimination, or antagonizing their action. Thus it has been stated (supporting the latter view) that if the basal ganglia have been cut off (by section of the pons) from their lower nervous connections, fever is no longer produced by injection of cultures of bacteria which readily cause it in an intact animal—while antipyrine has no influence on the temperature. These experiments were reported by Sawadowski.

Some observers have been unable to find any clear evidence of heat centers; that is, of localized portions of the central nervous system specially concerned in the regulation of the body temperature.

It is almost certain that some pyrogenic or fever-producing agent—cocaine, for example—acts indirectly through the brain or cord, and likely others affect directly the activity of the tissues in general, just as some antipyretics or fever-reducing agents, such as quinine, seem to act immediately upon the heat-forming tissues, while antipyrine affects them through the nervous system.

Variations in Temperature.[3]—The temperature of the body is not constant. It varies with the time of day, with eating, with age, somewhat with violent changes in the external temperature (hot or cold baths), and even possibly with sex.

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[1] For treatment of fever, see pages 511 and 512.

[2] Stewart's Physiology, p. 443. Article on "Animal Heat."

[3] The temperature as a diagnostic aid is described in Part I, page 11.

The lowest temperature is recorded between 2 and 6 A.M. The highest at 5 to 8 P.M. There is a corresponding fluctuation of pulse-rate at the same time of day.

Taking of food increases the temperature, but not more than one-half of a degree in healthy individuals. Entrance of food into the body increases metabolic activity, no doubt, through entrance of products of digestion into the blood.

Sex.—Females usually have higher temperature than males.

Relation of Age to Temperature.—There is a relative imperfection between heat regulation in old people and young children; thus, young children are more liable to sudden increase in temperature as well as to chills. A fit of crying will send up the temperature. Sudden fright (slamming a door) will send up the temperature (J. L. Smith).

Mosso reports that the rectal temperature rose three degrees in a dog rendered helpless with injections of curare. When injections of strychnine were given, this latter (strychnine) no doubt irritated the nervous system. He found that the presence of food was enough to cause the rise in the temperature of the dog.

Thus we find that the usual fever-causing factors are:—

1. Toxins.
2. Ferments.
3. Products of waste which are absorbed in the lymphatics (detritus).

We know that the regulation of the heat is brought about by the central nervous system, and we also know the influence brought about by the vasomotor (nervous system) in dilating and contracting the capillaries.

The discovery of Aronsohn and Sachs, that by traumatism or irritation of the corpus striatum, an elevation of temperature is produced, is still a question, doubted by many distinguished observers. But it certainly does look as though a certain center or centers exist which influence the body temperature.

Knowing then that other agencies besides disease cause an elevated temperature, the question arises: are we justified in designating every rise of temperature as "fever?" Hardly. An elevation of temperature (above normal) should be designated as "hyperthermia." We know that the fever is caused by the absorption of infectious products which later cause a breaking down and loss of the red blood corpuscles, breaking down of the tissues, and disintegration of albumin and its compounds, and produce symptoms pointing to distinct disorders in the human economy. Some authors have described fever under two headings or divisions:—

1. Septic.
2. Aseptic.

As an example of a septic fever, we have that chronic poisoning of the human organism which takes place in chronic pulmonary tuberculosis, and even in this latter toxæmic process we find sudden rises of temperature, which must be explained by emotional means, or rather by nervous causes. In a tuberculous patient whose system is overwhelmed with toxins (chronic and continuous poisoning) we can readily understand why the thermic centers as well as all other centers could be easily influenced to cause a sudden rise in temperature responding to a slight emotion or fright.

Let us now consider so-called "nervous" or, as it has been designated, "hysterical fever." The latter term we owe to the French authors (Pomme, Toussot, Baillon, Rivière). By this we mean a febrile condition which is not caused by any inflammatory or other disease agency, and which is found in either very nervous, neurasthenic, or hysterical patients.

Broussois (France) opposed this theory and believed this condition due chiefly to inflammatory changes in the ovary and uterus.

Briquet showed by careful examination the fallacy of the foregoing statements in a series of noteworthy investigations.

In 1888 Chaveau, in Paris, wrote a careful dissertation called "Fièvre Hysterique," and divided this condition into several distinct groups. A characteristic point is the absence of gastric disturbance (digestive), showing that it was not a malignant disturbance.

Chaveau looked to the cause of his cases in an abnormal excitation of the thermic center in sensitive (nervous) individuals. An accompanying factor he believes to be either traumatic or psychic disturbances.

Wunderlich (Germany) long ago called attention to the fact that hysteria influences the temperature, and that in hysterical neurosis we find sudden elevations of temperature. It is a remarkable fact and one noted by many others, that *one side of the body* shows this high temperature without any pathological condition manifesting itself.

Rosenthal (Vienna) found distinct localized areas of redness with marked rise of temperature in this area, but found no general febrile disturbance. The patient was decidedly hysterical. Strumpell agrees that he has found very high temperatures, irregularly, but believes the patients simulated their marked hysterical and irritable condition.

Ewald (Berlin) agrees that hysterical patients can produce high fever by reason of their excitement.

Hale White (England) doubts that the thermogenetic functions should cause high fever, and cites instances which were known as hysterical paralysis.

Cleman reported in the Clinical Society of London, 1883, a case of hysterical fever, showing the enormous temperature of 111° F. at various times.

Hale White believed that a mistake in reading the thermometer was made.

Ughetti believes hysterical fevers exist, and cites as proof of the same fever in course of hysteria, chorea, epilepsy, and Basedow's disease.

The greatest scientific contribution on this subject has certainly been the work of A. Sarbo in the University of Psychiatrie and Nervous Diseases in Budapest.[1] He believes as a result of experimental study, that the causation of fever should be looked forward to in the "central nervous system," and that the experimental discoveries of the thermic and vasomotor centers seem to confirm this. This author believes that fever, which has no organic lesion as a cause, should be called functional fever, which is a condition found in hysteria, the latter, a functional neurosis. It is interesting to record that Debone increased the temperature by suggestion to 101.2° F. or 38.5° C.

Krafft-Ebing records temperatures by suggestion as high as 106.4° F.

Sarbo concludes by saying that from his clinical observations a *distinct hysterical fever* exists.

Hysterical fever can simulate by its exacerbation and remission such diseases as typhoid, malaria, tuberculosis, and meningitis.

TABLE NO. 60.—*Showing the Ratio of Mortality from Infectious Diseases of Children Under Two Years of Age in New York City.*

Males.												
Tubercular Diseases . .	294	678	322	304	198	297	253	252	256	210	219	192
Diphtheria and Croup .	332	343	361	398	376	377	337	278	201	195	219	236
Measles	260	198	317	142	204	251	218	133	188	141	155	90
Whooping Cough . . .	164	137	122	205	74	172	154	99	167	132	107	53
Scarlet Fever	44	145	102	64	67	50	46	66	66	37	62	58
Phthisis Pulmonalis . .	54	42	61	58	49	74	50	52	47	53	50	44
Typhoid Fever	3	4	5	3	3	5	2	0	1	1	4	3
YEAR	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
Females.												
Typhoid Fever	2	3	4	2	2	1	2	2	1	0	2	2
Phthisis Pulmonalis . .	54	41	50	46	35	53	42	40	25	41	21	35
Scarlet Fever . . .	54	121	113	63	53	53	37	48	58	40	28	56
Whooping Cough . . .	212	140	162	221	121	219	179	139	186	139	123	72
Measles	240	232	261	121	182	265	221	134	136	125	157	72
Diphtheria and Croup .	259	287	289	283	410	316	262	287	136	201	172	200
Tubercular Diseases .	228	361	251	243	214	220	201	223	213	213	189	146

NOTE.—Various statistics and temperature charts were procured from the wards of the Riverside Hospital with the kind assistance of Dr. Watson, the resident physician.

I am also indebted to Dr. Henry L. Lynah for similar courtesies in the wards of the Willard Parker Hospital.

I am indebted to Dr. William H. Guilfoy, Registrar of the New York Health Department, for many courtesies in the preparation of the statistics of the various infectious diseases.

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[1] Published in the Archiv für Psychiatrie in 1891.

TABLE No. 61.—*Acute Specific Infectious Diseases.**

Disease.	Symptoms Begin After Exposure.	Characteristic Symptoms.	Other Symptoms.	Desquamation.	Complications and Sequelæ.	Duration of Disease.	Isolation.
Influenza.	1 to 3 days.	Fever, coryza, bronchial, gastroenteric symptoms, at times cerebral symptoms, such as convulsions—or stupor—with muscular twitching.	Crying as if in pain.	. . . .	Lungs. Kidneys. Intestines. Nervous system.	About 1 week.	2 weeks.
Pneumonia.	Indefinite. Usually a few days.	Disturbed ratio of pulse and respiration. Normal ratio, 1 : 4. In this condition 1 : 3 and frequently 1 : 2.	Cough. Bronchial breathing. Dullness on percussion. No expectoration.	. . . .	Kidneys. Meningitis. Empyema. Tuberculosis.	5 to 8 days or longer.	About 2 weeks.
Measles.	8 to 14 days.	Enanthem on Buccal Mucous-membrane. Dusky or purplish red, slightly elevated spots, crescent-grouped, seen on face first.	Begins with cold in head, running eyes, cough, eruption on fourth day. High fever.	Furfuraceous in character.	Eye. Lung (empyema). Tuberculosis. Ear (mastoid). Heart.	3 to 7 days.	2 to 3 weeks.
German Measles.	1 to 3 weeks.	Pale rose red spots or blush, not grouped, fades rapidly.	Slight fever, eruption on first day.	. . . .	Rare.	About 1 week.	2 weeks.
Scarlet Fever.	1 to 8 days.	Intense bright red blush over body beginning on chest.	Sore throat, vomiting, high fever, eruption first or second day.	Small scales.	Kidney. Ear. Heart.	Little over 4 weeks.	6 weeks, contagion during desquamation.
Chicken Pox.	1 to 2 weeks	Pea-sized vesicles filled with watery fluid.	Slight fever, eruption first day.	Small crusts.	Rare.	About 1 week.	2 to 3 weeks.
Smallpox.	12 days.	Papular stage is longer and the eruption ends with formation of pustules. Eruption is deep seated and hard, usually umbilicated. Frequently confluent vesicles, which do not collapse when pricked with a pin.	Convulsions frequently in children, fever, loss of appetite. Initial stage masked. Eruption largely on face, hands and feet.	Large crusts.	Larynx. Lungs.	3 to 4 weeks.	6 weeks.

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* Tetanus is described in Part IX., "Diseases of the Brain and Nervous System."

Diphtheria.	2 to 10 days.	White or grayish-white membrane on tonsils or pharynx.	Sore throat, weakness, fever. Pain on swallowing. Older children complain of headache.	. . . .	Lungs. Heart. Kidneys. Ears. Brain. Paralysis.	1 to 2 weeks.	3 to 4 weeks.
Whooping Cough.	2 to 7 days.	A long paroxysm of coughing followed by the crowing whoop at the end, frequently ending in vomiting.	Cough during first week of infection resembles bronchitis. Characteristic cough, often not seen until second week. Vomiting.	. . . .	Heart. Bowel. Hæmorrhages.	6 to 8 weeks.	As long as the whoop lasts.
Mumps.	1 to 3 weeks.	Glandular swelling below one or both ears, under the jaw.	Pain on chewing, inability to swallow.	. . . .	Orchitis. Abscess.	About 1 week.	3 to 4 weeks.
Typhoid Fever.	5 to 14 days.	Rose-colored, lenticular-shaped spots appear at the beginning of the second week. Eruption lasts 6 to 10 days. Fever, step-ladder type.	Diarrhœa or constipation. Sometimes convulsions. Enlarged spleen. Thirst. Prostration. Delirium.	. . . .	Blood. Lungs. Heart. Peritoneum.	21 days.	. . . . .
Acute Arthritis.	3 to 5 days.	Cachectic appearance. Swelling of the joint. Fever.	Pain.	. . . .	Heart. Ankylosis.	1 to 3 weeks.	. . . . .
Malaria.	1 to 14 days.	Intermittent fever. Cyanosis affecting nails.	Enlarged spleen. Convulsions. Prostration. Drowsiness. Vomiting.	. . . .	. . . .	1 to 2 weeks. In rare cases months.	. . . . .
Syphilis.	Not positively known.	Eruption sometimes diffuse, flush or roseolar, more frequently macular, occurring in dark red spots about the size of an infant's tooth. Occur mostly on face and extremities. Painful swelling at extremities of long bones. Pseudo-paralysis.	Cachexia. Wasting. Coryza. Onychia. Diarrhœa.	. . . .	Lungs. Peritoneum.	. . . .	. . . . .
Erysipelas.	3 to 7 days.	Painful swelling of the lymphatic glands of the region involved. Intense red color of the region involved.	Prostration. Fever. Vomiting. Diarrhœa, Convulsions.	Yellowish-brown Crusts.	Gangrene. Septicæima.	2 to 16 days.	Until after desquamation.

TABLE No. 62.—*Showing Ratio of Mortality from Infectious Diseases in Children Between the Ages of Two and Five in New York City.*

Males.												
Diphtheria and Croup	430	494	580	617	731	477	405	350	190	240	297	275
Scarlet Fever	99	319	244	142	127	149	106	127	119	83	77	151
Measles	105	95	113	47	70	105	118	52	58	45	67	48
Tubercular Diseases	82	72	81	92	82	86	98	86	85	89	90	67
Whooping Cough	40	28	32	39	26	38	29	31	28	25	32	11
Phthisis Pulmonalis	22	19	24	26	24	22	13	13	9	24	29	20
Typhoid Fever	5	9	7	4	2	3	7	5	4	2	5	8
YEAR	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
Females.												
Typhoid Fever	4	8	2	4	3	3	3	5	8	2	6	7
Phthisis Pulmonalis	21	16	23	27	20	16	21	23	19	26	18	18
Whooping Cough	56	39	45	59	43	50	57	31	51	46	41	19
Measles	87	102	122	59	85	132	116	50	49	46	55	40
Tuberculosis	85	74	77	72	83	98	79	66	65	80	65	71
Scarlet Fever	102	302	235	127	136	105	105	124	151	81	62	138
Diphtheria and Croup	432	465	494	612	701	449	430	254	203	257	279	273

TABLE No. 63.—*Showing the Ratio of Mortality from Infectious Diseases of Children Between the Ages of Five and Ten in New York City.*

Males.												
Diphtheria and Croup	151	163	160	226	249	146	180	128	65	74	131	95
Scarlet Fever	55	136	118	69	58	42	53	69	56	38	38	100
Tubercular Diseases	31	38	33	44	51	34	41	43	37	29	35	47
Phthisis Pulmonalis	22	30	24	35	35	21	24	28	28	33	29	30
Measles	16	18	18	9	20	15	16	6	6	16	15	14
Typhoid Fever	9	12	10	12	9	6	11	7	9	3	11	6
Whooping Cough	7	3	2	5	3	5	6	2	3	1	4	1
YEAR	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901
Females.												
Whooping Cough	6	4	8	12	5	10	10	1	6	6	9	2
Typhoid Fever	8	14	14	7	6	6	13	9	7	8	6	4
Measles	16	12	27	11	15	20	16	12	5	5	15	6
Tubercular Diseases	34	46	40	42	49	42	41	38	36	47	38	36
Scarlet Fever	45	165	131	68	72	57	52	59	56	48	32	102
Phthisis Pulmonalis	70	62	61	67	47	53	56	41	48	50	48	53
Diphtheria and Croup	152	182	185	283	275	181	167	170	103	86	138	115

TABLE No. 64.—*Showing Percentage of Deaths from Infectious Diseases in Children Under Ten Years, from 1890 Until 1902, in New York City.*

	MALES.		FEMALES.	
	Died.	Per cent.	Died.	Per cent.
Typhoid Fever	317	.006	252	.004
Phthisis Pulmonalis	1,228	.024	1,386	.027
Whooping Cough	1,928	.038	2,545	.050
Scarlet Fever	3,357	.066	3,104	.061
Measles	3,394	.066	3,294	.065
Diphtheria and Croup	10,576	.293	10,117	.200
Tubercular Diseases	4,857	.096	4,177	.082

CHAPTER II.

INFLUENZA (LA GRIPPE).

COMMONLY known as "grip" or "epidemic catarrhal fever."

This is an acute infectious disease with which catarrhal disturbances of the respiratory or gastro-intestinal organs are usually associated. There is also a profound nervous disturbance with marked perspiration and very high fever.

The disease occurs epidemically, spreading from case to case with great rapidity, so that it was formerly attributed to meteorologic conditions. It is for this reason known and described by the Germans as a "Blitzkatarrh." The disease occurs most frequently in cold and damp weather, and frequently attacks the same person several times.

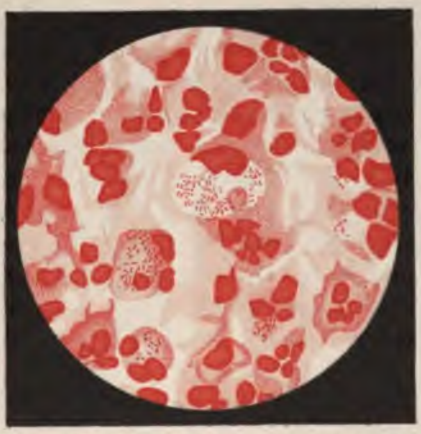

Fig. 148.—Influenza Bacilli. Sputum smear, stained with dilute Ziehl's solution. Bacilli chiefly intracellular, most of them show thickened ends. X 800. (Lenhartz-Brooks.)

Bacteriology.—The disease is caused by a very small bacillus, about 0.8 micro-millimeter long and 0.4 micro-millimeter broad.

This bacillus was first discovered by Pfeiffer, in 1892. It stains very intensely at the ends and resembles a diplococcus.

In the mucous membrane of the nose, throat, and lungs we find the greatest number of bacilli; thus, it is reasonable to suppose that the infection takes place through the respiratory tract, and in this manner the germs gain an entrance into the body.

The bacillus of Pfeiffer only is present in influenza. The poison generated by this germ resembles a group of bacterial proteins, described by **Buchner.** Such poisons occur within germs and are excreted, but only to a limited extent, in the media in which they grow. Examples of these germs are the diphtheria and tetanus bacilli. Such toxins affect the central nervous system very powerfully. Thus we find severe nervous depression in the course of an attack of influenza, just as we do in the course of a severe case of diphtheria. The influenza bacillus is frequently associated with other pyogenic bacteria. The tendency of mixed infection in the course of influenza is to generate pus. It is therefore a wise plan to examine the middle ear for possible suppurative conditions.

Not infrequently tuberculosis is associated with or follows a severe attack of influenza.

Symptoms.—When children are old enough to complain, then one of the most frequent subjective symptoms will be either a violent headache or pains in the muscles of the body. In young children and nurslings violent vomiting, associated with diarrhœa, may be the initial symptoms of the disease. While fever usually accompanies an attack of influenza, there are many cases in which a *subnormal* temperature is present. As has been previously stated, chills or rigors are seldom or never present.

Convulsions in young children are frequently a forerunner of an attack of influenza. The differential diagnosis between an attack of measles and influenza is sometimes quite difficult. Both commence with sneezing, coughing, and catarrhal symptoms, with suffused eyes, and an *eruption resembling measles* may frequently be found in influenza.

Diagnosis.—The diagnosis of this disease is sometimes very difficult. If an epidemic exists, or if several members in a family are attacked with grip and the children suddenly exhibit symptoms of malaise or have a disordered stomach, and show high fever without any apparent reason, then influenza should be suspected. If catarrhal symptoms associated with influenza present themselves, then such symptoms are of a more severe type than those usually seen in simple coryza.

An eruption resembling scarlet fever, complicated by tonsillitis or pharyngeal symptoms, will baffle the diagnostic ability of the physician, but the presence of influenza in a house will aid in eliminating other diseases and assist in establishing the true diagnosis. Not infrequently a child will suddenly show high fever and diarrhœa, with severe nervous depression, intense thirst, and typhoid tongue, with here and there small lenticular spots which may so resemble typhoid fever that only the course of the disease and constant watching will aid in making a correct diagnosis. Where such symptoms exist we must resort to an examination of the urine, and it is here that the diazo reaction will render material assistance. In addition to the examination of the urine, the Widal reaction should be resorted to. If both the Widal and the diazo reaction are absent, and if the depression and catarrhal symptoms resembling influenza continue, then, and then only, should the diagnosis of influenza be made. The fever is more irregular in the course of influenza than it is in typhoid, and usually shows an evening fall and a morning rise, which is the reverse of typhoid. The skin is usually very pale in typhoid and flushed in influenza. There are three definite types of influenza most usually met with in children:—

1. That affecting the respiratory tract.

2. That affecting the gastroenteric tract.

3. That in which the brain and nervous system are largely affected.

Respiratory Type.—When the respiratory tract is involved we usually have either a pharyngitis, tonsillitis, pneumonia, or a bronchopneumonia. When a very young child shows severe broncho-pneumonia and there is a general toxæmia associated with it, then the prognosis is usually very bad. A very frequent complication in this condition is tuberculosis; thus, if tuberculosis follows a severe attack of influenza in a young child whose system is undermined from a long and tedious disease, then grave results may follow.

Gastro-enteric Type.—In very young children this is the most frequent form of influenza. Vomiting and diarrhœa, usually accompanied by fever, will be found. The child will suddenly refuse to take the breast, if it is a nursling, or refuse to take bottle if it is hand-fed. It will also show great restlessness and seem dissatisfied and peevish. The sleep will be disturbed, so that insomnia is a very frequent symptom. In spite of careful dietetic

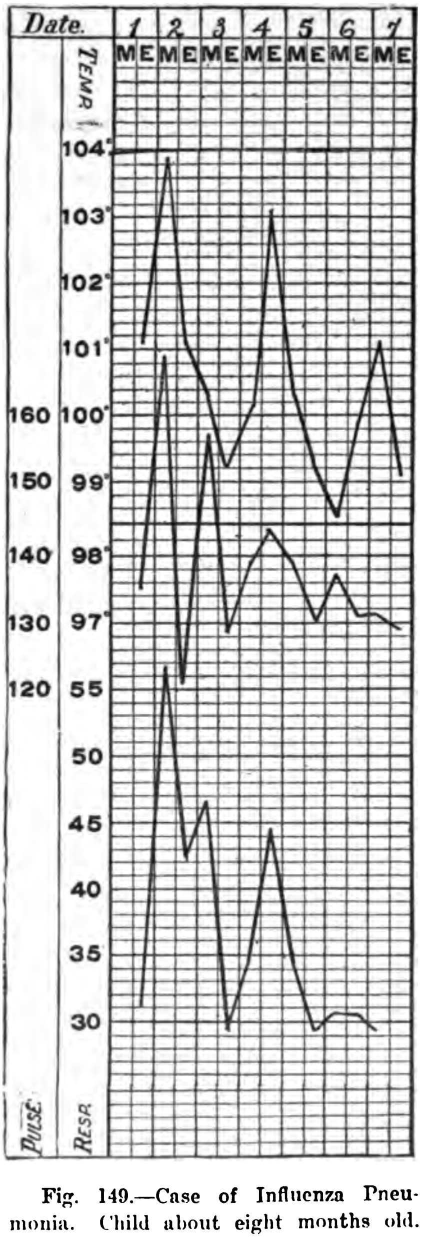

Fig. 149.—Case of Influenza Pneumonia. Child about eight months old. Suffered severe prostration from the toxæmia. Note the very high pulse-rate. Treatment consisted in using steam impregnated with beechwood creosote, mild laxative and careful diet. Case recovered. (Original.)

treatment and a thorough cleansing of the gastro-intestinal tract, the child will show the same clinical picture in mid-winter as we are familiar with in the course of a severe type of summer complaint in mid-summer. Convulsions are frequent, though not always present. Such children suffer severely, owing to the malnutrition and owing to the extreme exhaustion following a continued vomiting or diarrhœa. They lose flesh and resemble the atrophied condition following an acute summer complaint.

Nervous Type.—This is usually the most serious form of the disease, involving as it does, the brain and the nervous system. In this type we meet with extreme irritability, and if the child is old enough to complain then headache forms a prominent symptom, so also will pains in the limbs and in all the muscles of the body be complained of. Twitching is sometimes a marked symptom; convulsions are very frequent.

If the case of influenza is the only one in the family the physician may believe that he is dealing with a meningitis. Such symptoms as photophobia, stupor, coma, retraction of the head, are frequently present; the pulse is rapid, the temperature is frequently very high, although the usual temperature ranges between 101° and 103° F. When severe toxæmia exists it is not infrequent to find a subnormal temperature.

Complications. — Empyema sometimes complicates influenza. Some authors believe that it rarely exists, whereas during a recent epidemic the writer saw at least one dozen cases of influenza complicated by empyema. The same may be said of otitis media; thus a suppurative middle ear disease was noted a great many times during the course of the epidemic in 1903.

J. Madison Taylor contends that neuritis rarely follows influenza in children, whereas it is a common sequel in adults.

Nephritis occasionally complicates influenza.

Milton Miller[1] reports 40 cases of influenzal nephritis taken from literature. He reports a very interesting case of a child that had persistent vomiting and slight diarrhœa; later on œdema of the limbs and suppression of urine.

The course of influenza in children is hard to define. Some children will be ill a week or ten days; others will show the evidence of systemic infection months after an attack commenced. For this reason every case of influenza should be carefully supervised during the convalescence.

Prognosis.—This depends on the condition of the child prior to an attack. If, for example, an infant nursing at the breast is attacked with a severe form of influenza, then the prognosis may be reasonably good. If, however, the "bottle baby," with an existing rickets, is attacked in a similar manner, then the prognosis is certainly much worse than it would be otherwise; thus the general systemic condition prior to the infection of the grip will usually suggest the probable outcome of the disease. On the other hand a strong, robust child, having a severe form of influenza, complicated by middle-ear disease, with mastoid or cerebral complications, necessarily means a bad prognosis. The same rule would apply to all complications following an attack of influenza, in which exhaustion from a lengthy attack, besides the difficulty of properly feeding and sustaining life, would invite a fatal termination.

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[1] Archives of Pediatrics, January, 1902.

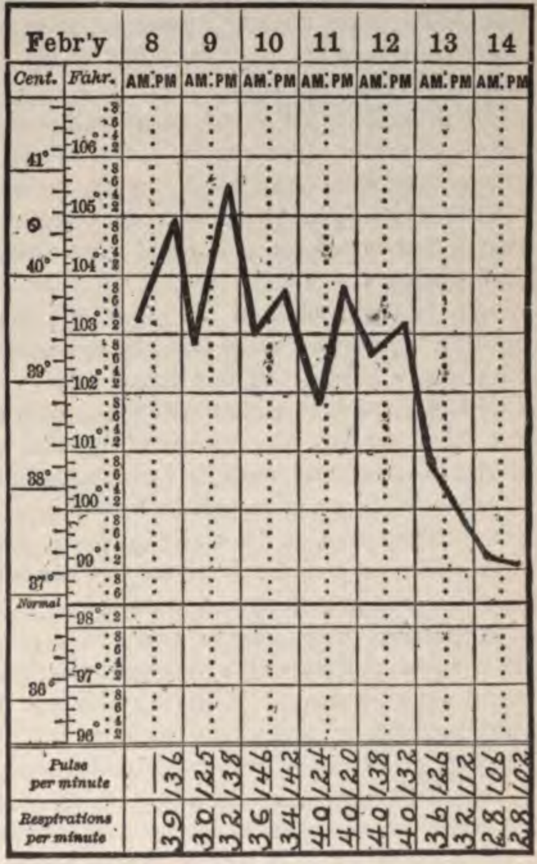

Fig. 150.—Case of Influenza Pneumonia in a Child Two Years Old. Note the irregular type of fever and compare the steady heart's action as indicated by the pulse. Child recovered. (Original.)

The sheet anchor of success would be the good condition of the heart, the exclusion of kidney complication, and also the fact that the infant takes a reasonable quantity of food. A progessive weakness of the heart or the devitalized state of the blood from prolonged pneumonia would mean a grave prognosis; thus all would depend on limiting the extent of the disease and the avoidance of complications.

Treatment.—In a case of grip it is advisable to isolate the child affected from the other children in the family. Next to isolation the child must be put to bed and kept warm. It is advisable to give a mustard foot-bath to stimulate the circulation, and follow this up by keeping either a hot water bag or bottles of hot water to the feet. If the head is very hot an ice-bag or cold, applied by ice-cold handkerchiefs to the head in the region of the fontanels, would be indicated. If high fever exists then 15 to 30 drops of sweet spirits of niter, repeated three times in intervals of one hour, will not only aid the kidneys, but also have a slight diaphoretic effect.

A favorite formula of mine is *tincture aconite rad.*, 1 drop, combined with *spiritus mindereri*, $^1/_2$ teaspoonful, freshly prepared, and kept in a cool place. The above to be given every hour until the temperature is reduced or until perspiration appears.

The stomach and bowels require very careful attention in the gastric type of this disease; thus a good plan is to commence by giving a small tablet, containing $^1/_{10}$ grain of calomel, with a little water, every hour for six doses, or until the effect of the calomel is manifested by the greenish stools.

If the child is old enough then small pieces of cracked ice or ice cream may be given for several hours. If vomiting persists after the ice cream then nothing should be given by mouth for six hours.

During such time, when there is severe irritability, medication may be given, either in the form of rectal suppositories, or, if possible, by hypodermic means.

An ice-bag applied at the pit of the stomach will frequently arrest vomiting. An ether spray over the epigastrium for a minute will sometimes relieve a persistent vomiting.

Liquid food in a concentrated form, such as broths, soups and cereals, steak juice, raw beef juice, white of egg and water, or the yolk of an egg added to concentrated soup, is very nourishing if the stomach can retain the same. Calisaya is one of the best tonics. If the stomach is not irritable nitroglycerine, in doses of $^1/_{200}$ grain, will do good.

Strychnine, persistently given, is indicated in the course of convalescence just as it is indicated in diphtheria.

Peptonized foods, chiefly milk and peptonized broth, may be necessary if we are dealing with a prolonged gastric type of the disease with subnormal digestive power. When convalescence is established then syrup of hypophosphites, or phosphorus combined with codliver-oil, or the glycerophosphate of lime, will be found advantageous.

No matter how slight an attack of influenza has been encountered it is well, when convalescence is permanently established, to insist on a change of air to the South, if in winter, to such places as Virginia Bay, Old Point Comfort, or Florida, or if in the summer to places like Lakewood, or, better still, Atlantic City. If we have encountered a severe form of this disease with extreme emaciation and loss of tone, then a radical change of air to a more balmy and permanent climate, such as is found in Southern California or in New Mexico, should be recommended.

If bronchial catarrh persists with expectoration, or if we are dealing with an incipient form of tuberculosis, following this attack of grip, then a change of air to Colorado, and out-door life, may be the means of arresting the disease and effecting a cure.

Alcoholic stimulation must depend on the individual case. If the infant assimilates milk, broth, cereals, and the pulse is good, then alcoholic stimulation is unnecessary. If, however, the pulse is weak and very little or no food is taken, then it may be necessary to give whisky, especially so if the pulse is feeble and the heart shows signs of weakness. Champagne may be given if persistent vomiting, with exhaustion and heart strain, manifests itself.

The value of coffee freshly made, to which some milk is added, must not be forgotten. Caffeine may be substituted if coffee is not at hand.

Carbonate of ammonia, in doses of 1 grain for a child of 1 to 2 years old, repeated every two or three hours, will be useful as a stimulant during the course of extreme exhaustion following the respiratory type of this disease.

To stimulate the circulation if extreme cyanosis or cold extremities persist, nothing will equal judicious massage. Cupping or other forms of depletion should not be practiced unless severe meningeal symptoms or constant convulsions demand the same. Dry cupping over the chest will be found useful to relieve the shortness of breath at the onset of pneumonia.

In cupping it is advisable to use two cups anteriorly and four cups posteriorly at the same time. The pulse should be watched, and if any irregularity presents itself then cupping should be immediately discontinued.

The depressing effects of the coal-tar products, such as antipyrine and phenacetine, should be remembered. If such drugs are used they must be combined with camphor or musk to counteract the depressing effect on the heart.

The fever is rarely so high that we must resort to antipyretic drugs. I have seen good results from sponging the body with alcohol and water, or with acetic ether, repeated every hour or every half-hour if necessary. If the temperature persists a cool pack should be applied to the upper half of the body. This pack should consist of a sheet wrung out of cool water. The temperature of the cool pack is 80° F. These packs should be repeated every fifteen minutes if the temperature is 105° F. or over, and every thirty minutes if the temperature is 103° or 104° F. The same treatment should be continued until the temperature falls to 102° F. or lower.

Iron may be necessary for months after an attack of influenza. The more simple forms of iron, such as neoferrum, are easily assimilated by a child. A preparation that the writer uses frequently is tinct. ferri. acet. æth., in doses of 5 to 20 drops diluted with water, three times a day. This form of iron is easily digested, will restore tone to the system, and increase the red blood-corpuscles if continued for some time.

CHAPTER III.

PERTUSSIS (WHOOPING-COUGH).

This acute infectious disease is caused by a specific micro-organism.

Etiology.—The disease usually gains entrance to the body when the infant is in a subnormal condition. We must therefore expect to find the greater number of cases in tenement houses, and in the crowded districts of the poor.

Whooping-cough is frequently associated with measles.

Babies brought up by hand-feeding, so-called bottle-babies, suffer severely and are infected more readily than infants that are breast-fed.

TABLE No. 65.—*Statistics: Deaths from Whooping-cough in Children Under 15 Years in Old City of New York.*

			0 Years	1 Year	2 Years	3 Years	4 Years	Under 5 Years	5-10 Years	10-15 Years
1890	Males	211	115	49	30	4	6	204	7	
	Females	274	133	79	33	17	6	268	6	
1891	Males	168	95	42	16	8	4	165	3	
	Females	183	96	44	29	6	4	179	4	
1892	Males	156	71	51	18	9	5	154	2	
	Females	215	104	58	26	10	9	207	8	
1893	Males	249	122	83	25	9	5	244	5	
	Females	292	126	95	34	17	8	280	11	1
1894	Males	103	57	17	17	5	4	100	2	1
	Females	169	76	45	27	9	7	164	4	1
1895	Males	215	114	58	24	8	6	210	5	
	Females	279	127	92	30	10	10	269	10	
1896	Males	189	112	42	10	13	6	183	6	
	Females	246	113	66	34	18	5	236	10	
1897	Males	132	73	26	17	13	1	130	2	
	Females	176	87	52	12	14	5	170	1	
1898	Males	198	105	62	18	8	7	195	3	
	Females	243	116	70	24	20	7	237	6	
1899	Males	158	74	58	13	11	1	157	1	
	Females	191	99	40	30	10	6	185	6	
1900	Males	143	69	38	23	3	6	139	4	
	Females	173	78	45	21	15	5	164	9	
1901	Males	65	31	22	7	3	1	64	1	
	Females	93	43	29	8	7	4	91	1	1

A disease whose death-rate, in children under 5 years of age, ranks fourth, certainly requires attention. In delicate children it is one of the most serious diseases we can encounter.

It is one of the most frequent diseases of childhood and is both infectious and contagious. It is divided into three stages:—

First Stage.—The catarrhal stage in which the symptoms of an ordinary bronchitis appear.

Second Stage.—The paroxysmal stage in which the characteristic whoop appears.

Third Stage.—The stage of decline after the spasms have spent their force.

Bacteriology.—Behla found a micro-organism which he believes belonged to the protozoa group. Similar results were obtained by Deichler and Kurloff. In 1887 Affanasjew found a bacillus which he called the bacillus tussis convulsiva. This germ has been isolated from the expectoration found in the larynx and trachea.

Czaplewski and Hensel have found a facultative anaerobic bacillus resembling, morphologically, the influenza bacillus, but somewhat larger. It has been impossible to make a pure culture of this so-called specific micro-organism and reproduce the disease in animals.

Pathology.—We find an intense congestion in the lungs, heart, kidneys, and meninges. The immediate cause of the paroxysms of whooping-cough must be attributed to a nervous origin. It has been found, experimentally, that an irritation of the superior laryngeal nerve will provoke a spasmodic cough similar to whooping-cough. When this disease exists a long time there is a profound toxæmia, which is similar to that form of poison so commonly met with in severe infection resembling diphtheria.

Symptoms.—After an exposure to whooping-cough symptoms may appear as early as three days, though sometimes not until one or two weeks after such exposure.

During the first stage the diagnosis is at times very difficult. If one or more cases exist in the immediate surroundings, and an exposure to whooping-cough is brought out by the clinical history, then it is likely we are dealing with whooping-cough.

The catarrhal stage lasts about one week; not more than ten days. Besides the symptoms of bronchitis above mentioned, we have a history of the child coughing more at night than by day, and less in the open air than when brought into the house. The usual cough remedies will not check this cough. The child will not relish its food. There is a craving for liquids, although all food seems to irritate and excite the cough.

Associated with this loss of appetite, there is usually a looseness of the bowels and diarrhœa, which particularly affects the colon and produces a mucous stool.

The Paroxysmal or Whooping Stage.—The whoop or paroxysm is usually heard in the second or third week after the infection has taken place. The paroxysm commences with a severe cough, followed by a long inspiration which has the distinct whoop. The face assumes a reddish or cyanotic appearance during this coughing paroxysm. The coughing spasm usually ends in vomiting.

When the paroxysms are very violent severe nose bleeding or hæmorrhage may follow a paroxysm. Sudden death has followed paroxysms, evidently due to cerebral hæmorrhage.

I have frequently had the number of paroxysms counted in twenty-four hours, and twenty to fifty are not unusual in a severe form of pertussis.

The face has a characteristic puffy appearance when the paroxysms are well established. The skin will frequently show an intense capillary congestion, which can most frequently be seen by an inspection of the conjunctival mucous membrane.

Here we will find an engorgement of the smaller blood-vessels distinctly evident. The paroxysmal stage lasts from four to ten weeks, although the writer has seen cases in which the whoop remained six months, and even longer.

After the disappearance of the whoop the catarrhal stage appears, and convalescence is usually established.

Ulceration of the Frenum of the Tongue.—This seems to be directly due to the forcible pushing forward of the tongue during the paroxysm of cough. This stretches the frenum and brings it in contact with the teeth, causing ulceration.

The Stage of Decline.—The symptoms of the third stage or stage of decline resemble those of the first stage. Catarrhal symptoms continue. There is extreme exhaustion from the paroxysms of cough. It renders the child very livid. Profound anæmia and heart failure are most frequently met with in this stage.

Particular care must be given to the restoration of the normal functions of the heart and the respiratory tract; also in toning up the stomach and bowels. Cold extremities are met with, showing a poor circulation of the blood.

Diagnosis.—The diagnosis cannot be made by an examination of the sputum, as we have described in the case of bacteriological examination in diphtheria on page 557.

One attack of whooping-cough usually renders the child immune. This is, however, not always the case. Cases are recorded in which whooping-cough has appeared a second time.

Complications. The most frequent complication seen by me is broncho-pneumonia. Chronic pulmonary disease, such as tuberculosis, has frequently followed pertussis. Empyema has been seen by me associated with pertussis. The heart must be carefully watched and cardiac stimulants given when weakness is noticed. Heart-strain from the paroxysms has occasionally caused death. Epistaxis of a very serious nature may result from a violent spasm. Cerebral hæmorrhage and sudden death due to apoplexy has followed violent paroxysms of cough. Prolapse of the rectum is a common occurrence when the spasms are prolonged. Hernia may also result from severe spasms. I have seen umbilical and inguinal hernia very frequently during the spasmodic stage of pertussis.

The danger of suffocation must not be forgotten and intubation of the larynx (see chapter on "Intubation") may be required.

Convulsions are not frequently met with in the course of this disease. The writer met with a case of pertussis in which death resulted from convulsions after a coughing paroxysm. They are usually fatal when they do occur. Paralysis frequently follows severe spasms caused by intracranial hæmorrhage. Such paralysis usually improves under careful treatment, and not infrequently do we find children completely cured after a distinct stroke of paralysis. Strabismus occasionally follows this disease.

Aphasia and loss of vision are sometimes encountered. These conditions frequently improve when the system is strengthened by restorative treatment.

Bloody urine is frequently met with in very young children during the course of a severe attack of pertussis.

Nephritis is sometimes met with and may last for months after the disease has disappeared. Diabetes mellitus has been reported following an attack of whooping-cough. The writer has seen a case of this kind, extending over two years, which resulted favorably.

Prognosis and Course.—This depends upon the presence or absence of complications. When laryngeal complications such as œdema of the glottis exist, the prognosis is grave. If broncho-pneumonia is present and the heart is weak, then the prognosis is doubtful. Atelectasis involving part of the lobe or even several lobes of the lung is usually met with in rickety children, and results fatally. When pleurisy complicates whooping-cough, a guarded prognosis should be given. If an effusion exists the same should be watched until it is absorbed. If an empyema complicates a case of violent pertussis the prognosis is very poor. Emphysema is frequently met with when there is severe and frequent coughing. When this latter complication exists recovery is very slow.

Treatment.—*Prophylactic Treatment:* When a case of whooping-cough occurs in a house, it is a good plan to give the other healthy children from 5 to 10 grains of sulpho-carbolate of sodium, three or four times a day for two weeks. This will be during the longest period of incubation. Exercise in the open air, walking, etc. Fresh air at night by proper ventilation, and dietetic measures may be the means of preventing an attack of pertussis.

Owing to the contagious character of this disease we must insist on the *strictest isolation* of every child suffering with whooping-cough, until the last vestige of cough has disappeared. The specific infectious character of this disease demands the strictest attention to the disinfection of every bit of clothing worn by such a child. In addition thereto all expectoration or vomit must be disinfected by the addition of a 1 to 2000 solution of bichloride of mercury. It is only in this manner that we can destroy the infectious agent which is known to transmit this disease. A child suffering with whooping-cough must sleep alone, and if at all possible, should have separate dishes and utensils during the whole course of this disease.

Feeding.—Next in importance to hygienic measures is feeding. If an infant at the breast has whooping-cough, then it is a simple matter to regulate its food. If spasms of cough are followed by frequent vomiting, then the writer insists on feeding the nursing infant soon after the spasm ceased. When coughing spasms are provoked to such an extent that no food will be retained, and if there is a very feeble pulse, and exhaustion following such inanition, then, and then only, must we resort to *rectal feeding.* This form of feeding has been described elsewhere in this book. (Read chapter on "Rectal Feeding.")

When vomiting is very serious, Baginsky recommends menthol in doses of $^1/_{10}$ or $^1/_4$ grain, repeated every two hours until the desired effect is produced. Frequently the inhalation of chloroform or ether may be necessary to check the paroxysms and relieve vomiting.

Hygienic Treatment.—The intelligent management of a case of whooping-cough depends on the environment in which the patient exists. Thus if a child suffers with severe whooping-cough and lives in a crowded apartment in the city, it will be immediately benefited by a change to the country. Whether such children be given mountain air or removed to the seashore is immaterial. The pine-needle air of the woods or mountains is certainly beneficial. The same is equally true of the ozone at the seashore, or on an ocean trip. Thus one child will be benefited by a trip to Europe, while another will receive an equal benefit by being sent to the mountains. When, however, neither of these trips are possible, then common sense must be used.

The first remedy demanded is fresh air. It is advisable to insist on having the windows open both night and day if the child is indoors, and to instruct the mother or nurse regarding the *necessity of fresh night air* as well as *fresh day air.*

There seems to be a predilection regarding the danger lurking in night air, and children are crowded into stuffy apartments and permitted to breathe vitiated air at night rather than open the windows. This is the real cause of such children coughing more at night than during the day. The administration of oxygen and also of ozone has its advocates. All noxious odors and all irritants, such as tobacco smoke or kitchen vapors, must be guarded against; in other words, the air should be kept as pure as possible.

Medicinal Treatment.—We have no specific in the treatment of this disease. For the treatment of whooping-cough hundreds of remedies have been suggested. Some of the older remedies, such as belladonna, hyoscyamus, codeine, and morphine, have their advocates.

There is no question in my mind about the efficacy of some of the remedies just mentioned. In spite of the value of those drugs, a great many cases will show no benefit after their use.

Every pediatrist is guided by his individual experience, and thus it is that one remedy will do good in a certain class of cases and disappoint in another.

Bromoform[1] was introduced in this country by the author.

In a series of 51 cases published at that time, marked improvement was the rule in most cases, although there were several instances in which no appreciable benefit was observed.

The dose of bromoform is from 2 to 5 drops three times a day, for a child 1 year old. It is wise to begin with a minimum dose and gradually increase the same to the point of toleration. We commence with a 2-drop dose, give it three times a day, then increase 1 drop more each day until a decided amelioration of the paroxysms is noticed. My plan has been the following: To instruct the mother or nurse to count the number of paroxysms that the child has in twenty-four hours.

℞ Bromoform	1	drachm
Spir. vini albi	$2\,^1/_2$	drachms
Syr. tolu	1	ounce
Mucilag. acacia	q. s. ad 2	ounces

M. From $^1/_2$ to 1 teaspoonful every four hours.

Owing to the extreme volatility of this drug, great care must be exercised in its administration, and it is a good plan to keep the same in a well-stoppered bottle and also in a cool place.

The increase of the dose of bromoform depends on the point of tolerance. Thus, if the child appears very drowsy and sleepy and shows signs of intoxication after a 3 or a 4-drop dose, then it is a good plan to combine a small dose of caffeine citrate with it, or if the child is old enough, give it a few drops of strong coffee after the dose of bromoform has been given.

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[1] The article appeared *in extenso* in the New York Medical Record for September 6, 1890.

The writer has frequently given 7, 8, 9, or 10 drops of pure bromoform in one dose to an infant 1 year old, by gradually increasing the dose from two drops in the manner above described.

Bromoform acts similarly to chloroform and it is advisable to use extreme care with children who might be very susceptible to ordinary drug treatment. Children suffering with profound anæmia or rachitic children, or children having tuberculosis, or those suffering with syphilis, should be carefully watched.

Toxic effects have been reported both in this country[1] and abroad.

Antipyrine, in doses of 1 to 5 grains three times a day, acts quite well in some cases. It is well worth trying, especially in very nervous children.

Tussol.—Tussol is a derivative of antipyrine and has been advocated by Rehn[2] and later by Rothschild,[3] and in an elaborate paper by Dr. Urban, from the Children's Hospital of Vienna.

The writer has had some experience with tussol and has found instances in which the paroxysms were modified just as they were when phenocoll or antipyrine was used. The method of administering it was to suspend it either in syrup of orange or raspberry syrup, in doses varying from 2 to 5 grains for a child 1 year old, older children, larger doses in proportion.

What has been said regarding the depressing effect on the heart by the antipyretic group applies equally strong to this latter day drug. When large doses are given, then some cardiac stimulant should be combined with it to offset the depressing action on the heart.

Fischal[4] gives a clinical report regarding the newer remedies suggested in the treatment of whooping-cough, as lactophenin and euchinin. These belong to the antipyretic group. Other substances have been recommended in this disease. Among the newer remedies suggested are pasterin, antitussin, pertussin, antispasmin.

Antitussin.—A conscientious trial of this drug in the children's service of the writer, showed no benefit whatever after its use. Hein advocates the use of antitussin.[5]

Fischal has seen the paroxysmal curve of 21 daily, drop to 7 daily, immediately after using antitussin. Several days sufficed to complete a cure.

Phenocollum hydrochloricum has been before the profession for a number of years; Martinez Vargas, in Barcelona, advocates the use of this drug, after giving detailed clinical histories in an extensive article.[6]

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[1] "Bromoform Poisoning, Recovery in a Child," published in detail in the Annals of Gynæcology and Pediatry, 1897 (Fischer).

[2] Munch. Med. Wochen., 1894, No. 46.

[3] Berlin. Klin. Wochen., 1896, No. 1.

[4] Med. Chir. Centralblatt, June 29, 1900.

[5] Berlin. Klin. Wochen., No. 50, 1899.

[6] Therapeutischen Wochenschrift, January 5, 1896.

We found beneficial results in a series of cases in which a great many other drugs had been previously used. A child one month old received about 10 grains of phenocoll in the course of twenty-four hours.

The action of phenocoll is reported to be very quick. It passes through the system and is excreted in about twenty minutes.

Kobert and Mering found that phenocoll does not alter the character of the blood. It reduces the temperature, diminishes the quantity of urea and of nitrogen, and also the total solids in the urine. It seems to exert its influence on the nervous system, causing a decrease in the convulsive character of the cough.

The slightly bitter taste of this drug can be masked by adding a little syrup. It acts not only on the nerve centers, on the cerebellum and spinal cord, but also on their peripheral ramifications, producing a slight warmth in the head and flushing the face. It determines varying degrees of dilatation of the pupil, especially when administered in large doses; thus mydriasis persists even after all other characteristic symptoms of phenocoll have disappeared.

The dose is from 5 grains, for a child 1 year old, gradually increased to 8 grains, administered in water or syrup three times a day until the effect is marked.

Phenocoll has also been advocated by Vergas and Grigorieff, and by Polievkstoff in Petersburg. The writer has had some experience with phenocoll, and has found that very mild cases seem to respond to its administration in the same manner as antipyrine has given results. Specific action and immediate relief in severe paroxysmal attacks was not noted.

Antispasmodics.—When the paroxysms of whooping-cough are very severe, especially at night, causing insomnia, it is very vital to give the child some sleep. The antispasmodics, like belladonna, require either the addition of bromide of sodium or bromide of potassium. A 5-grain dose of bromide of sodium, administered shortly before putting the child to bed, will frequently allay irritation and give refreshing sleep. The dose may be doubled and 10 grains of bromide of sodium given to a child 1 year old, if a 5-grain dose has had no effect. Frequently from 1 to 2 grains of chloral hydrate added to a 5-grain dose of bromide of sodium will act more beneficially.

When drugs are not well borne by the mouth and the slightest amount of liquid swallowed will cause an irritation and provoke a paroxysm of cough, then it is advisable to feed the child per rectum. We can also administer the drugs in the form of suppositories per rectum. It is a good plan to increase the dose per rectum; thus if a child receive 5 grains per mouth, then 10 grains should be given for a corresponding dose per rectum.

Regarding Antitoxin.—Whooping-cough is a self-limited disease, and one single attack is usually protective against subsequent infection. Thus it appears that some antitoxin may possibly be generated during convalescence.

As soon as a specific micro-organism can be cultivated and the disease reproduced in lower animals, just as we can to-day isolate the specific micro-organism causing diphtheria, then we may hope for an antitoxin.

Vaccination of the arm with bovine virus has been advocated by some in the treatment of whooping-cough. The writer has never seen any benefit from its use. It can do no harm if a child has never been vaccinated.

Anti-pneumococcic serum has been advocated by many for the treatment of whooping-cough. Why it should be used I fail to understand and cannot conscientiously recommend the use of the same in this disease.

Creosote or creosote carbonate has been advocated by some in the treatment of the paroxysmal cough. It has served the writer very well in conjunction with codliver-oil and malt as a restorative, after the paroxysms had spent their force, but no specific action could be ascribed to the use of creosote carbonate alone or in combination.

When whooping-cough existed in a tubercular child, then marked benefit was noted by the administration of 2 to 5 drops of creosote carbonate three times a day, given in milk, soup, or broth, and the dose gradually increased until 12 drops, three times a day, was administered. The benefit derived in these cases must be attributed to the action of creosote for the tuberculosis, rather than its specific action in whooping-cough.

Steam Inhalations.—Medicated steam is frequently useful, more especially when the cough is violent. When pertussis is complicated by bronchitis steam vapor should be used every five or six hours. A teaspoonful of beechwood creosote added to a pint of steaming water and placed several feet from the child's bed, will impregnate the air in the room.

Heroin has been extolled by many as a useful adjuvant in the treatment of catarrhal affections. The following case is interesting to show the dangers of idiosyncrasies in some children:—

An infant, eleven months old, very rachitic, poorly nourished, was exposed to whooping-cough in a large apartment house. The paroxysms were violent and frequently ended with vomiting. The child was greatly exhausted from cough and weakened from inanition. Expectorants and antispasmodics excited little or no influence over the cough.

Heroin, $^1/_{60}$ grain, was prescribed three times a day for three days. This produced a distinct stupor. Such was the condition noted by me when I saw the case in consultation with Dr. John H. Wurthman. There was no rigidity of the sterno-cleido mastoid nor was opisthotonos present. The patellar reflexes were present. The symptoms subsided when the drug was discontinued and cardiac stimulants were prescribed. The symptoms were undoubtedly due to heroin poisoning. It is possible that we were dealing with a drug idiosyncrasy as the toxic symptoms passed away in about twenty-four hours.

Dionin in pertussis has been recommended by Von Mering in the following doses:—

For a child 1 year old:—

℞ Dionin (Merck)	1/6 grain
Aqua	3 ounces

Sig.: One drachm every three hours.

For a child 2 years old:—

℞ Dionin	1/3 grain
Aqua	3 ounces

Sig.: One drachm every three hours.

For a child 3 years old:—

℞ Dionin	1/2 grain
Aqua	3 ounces

Sig.: One drachm every three hours.

Pertussin[1] has been used by me for several years with remarkably good results. I have given a teaspoonful three and four times a day. To older children 2 teaspoonfuls three and four times a day, also at night until the paroxysms were modified.

Restorative Treatment.—Malt extract with hypophosphites and cod-liver-oil, sweet cream, milk, eggs, and butter form the most valuable part of the treatment.

Produce Sleep at Night.—Next to exhaustion from violent paroxysms of cough, heart strain, and loss of food from vomiting, is loss of sleep. Sleep should be produced to aid in restoring normal conditions. Trional in 1 to 5-grain doses, repeated in two hours, is very useful in some cases. I have previously mentioned the good effects of bromides as antispasmodics. Paregoric in 10 to 20-drop doses, according to the age and requirement of the case, will be found useful in some cases. A large dose (tablespoonful) of castor-oil will frequently exert a very soothing effect on the inflamed and sensitive mucous membrane.

Spray.—A 3 per cent. *cocaine* spray in the throat, used several times a day, or a 3 per cent. *eucaine* spray will frequently give local relief if severe paroxysms are followed by vomiting. The writer has frequently given the latter spray in conjunction with one of the above-mentioned drugs.

Ethyl chloride has been used as a spray during violent spasms. It produces anæsthesia, thus affording temporary relief. An oil spray, consisting of albolin or liquid vaseline used with an oil atomizer, lubricates the mucous membrane and sometimes affords relief.

The Naso-pharynx.—Reflex irritations such as nasal catarrh and adenoids frequently excite paroxysms of cough, hence they should be removed by operation if present.

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[1] Sold in drug stores. Made by Taeschner.

A mild antiseptic irrigation of the naso-pharynx will be found advantageous.

For this purpose use:—

℞ Dobell's sol.	1 part
Aqua	3 parts

The above can also be used in the form of a steam spray directed against the pharynx.

Seiler's tablets are also valuable. One tablet dissolved in a teacup of lukewarm water, or:—

Mechanical Treatment.—The value of an abdominal binder as a support in the treatment of whooping-cough is emphasized by Kilmer.[1]

My personal experience has been quite good with this form of support. It probably gives the same mechanical relief as does the strapping in pleurisy.

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[1] Section on Pediatrics, American Medical Association, 1904.

CHAPTER IV.

PNEUMONIA (LOBAR OR CROUPOUS).

THIS acute infectious disease is frequently seen in infancy and childhood. It is caused by the invasion of a specific micro-organism, the pneumococcus, also known as the micrococcus lanceolatus. The disease rarely exists longer than from six to nine days. It terminates by crisis. It is a self-limited disease. In some cases it may terminate by lysis.

Etiology.—This disease most frequently exists in children between the ages of 5 and 10 years. Baginsky states that among 173 pneumonias studied by him, he found the following:—

6 children less than 1 year old.
28 children between 1 and 2 years.
58 children between 2 and 5 years.
63 children between 5 and 10 years.
18 children between 10 and 14 years.

We find on studying the above cases that the greatest number of pneumonias are found in children between the ages of 5 and 10 years. Schlesinger studied a series of cases of pneumonia and found that 96 cases affected the right lung as against 66 cases affecting the left lung. He also found on the right side of the lung:—

22 cases affecting the upper lobe.
7 cases affecting the middle lobe.
32 cases affecting the lower lobe.

On the left side of the lung:—

11 cases affecting the upper lobe.
00 cases affecting the middle lobe.
47 cases affecting the lower lobe.

Thus he found that the lower lobes on both sides of the lungs were more frequently affected than the upper lobes, and that the seat of pneumonia in children corresponded with the investigations of Von Dusch, showing that the most frequent seat of pneumonia of the lobar variety is certainly found at the base of the lower lobe of the left lung. This is an important diagnostic point when symptoms point to the development of pneumonia.

Bacteriology.—The disease originates by an invasion of a specific micro-organism first described by A. Fraenkel. Other investigators, among them Klebs, Ziehl, and C. Friedlander, have found various micro-organisms in the lymph channels, and in the alveoli of pneumonic lungs. Some of these germs have been encapsulated. It remained, however, for Fraenkel to find the specific germ causing this disease. Weichselbaum was one of the first to prove the positive specific infection of the Fraenkel diplococcus.

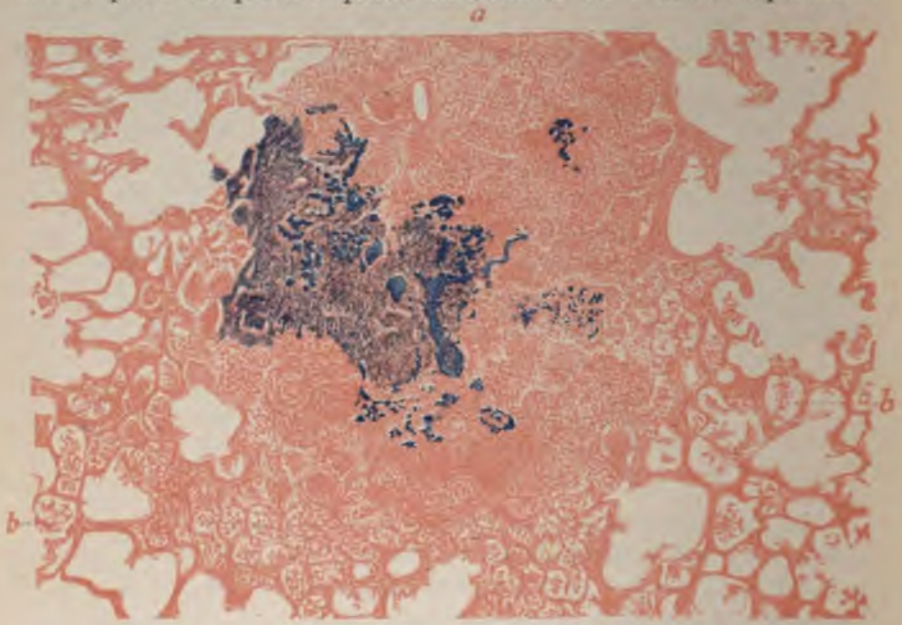

Fig. 151.—Focal Metastatic Hematogenous Streptococcus Pneumonia Following Angina. (*a*) Pneumonic focus with streptococci (blue) inflamed surrounding tissue. X 80. (Ziegler.)

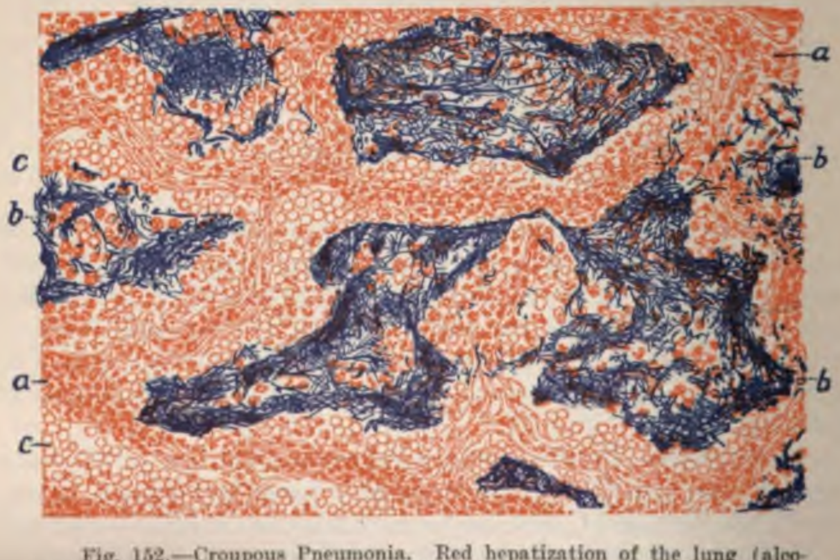

Fig. 152.—Croupous Pneumonia. Red hepatization of the lung (*alcohol, carmine, fibrin-stain*). (*a*) Infiltrated alveolar septa; (*b*) fibrinous *exudate*; (*c*) red blood-cells. X 200. (Ziegler.)

This diplococcus is found not only in the lungs, but frequently also in the meninges, in the nasal secretions from the nasal mucous membrane, and at times in the kidneys. Wherever this micro-organism is found there is usually an inflammatory condition resulting therefrom.

When this specific germ was injected into animals, pneumonia always resulted.

Pathology.—There are four stages which have an important bearing on the progress and on the outcome of this disease. First, the stage of congestion; second, the stage of red hepatization; third, the stage of gray hepatization, and fourth, the stage of defervescence or resolution.

VARIETIES OF PNEUMONIA.

Abortive Pneumonia.—This form of pneumonia is frequently disbelieved by some clinical observers. At times children who are in apparent good health will suddenly have intense fever, cough, and on physical examination show distinct symptoms of pneumonia. Frequently dullness on percussion in addition to bronchial breathing will be plainly made out. In two, possibly three days, the whole clinical picture will be changed and the child will appear to be normal. This form of pneumonia has been recognized and studied by other authors, but Baginsky maintains that the disease is of the abortive type. It is quite possible that some of these symptoms have been latent for several days prior to the detection of the physical signs, and thus what appears to be an abortive form of pneumonia covering two or three days may easily have existed for several days prior to the detection of the same.

Pneumonia Gastrica.—This form of the disease is one in which the symptoms of vomiting and diarrhœa predominate, and hence it is known as the gastric type of pneumonia. While the lungs will show the usual symptoms of a croupous pneumonia, the tongue, stomach, and bowels will present symptoms of an intense inflammatory condition of the digestive tract. Not infrequently jaundice may be present.

The conjunctival mucous membrane may be pigmented from the presence of bile. The secretions may also show biliary pigmentation. Herpes may appear on the upper lip, thus showing that there is an intense inflammatory condition affecting primarily the digestive tract.

Wandering Pneumonia ("Pneumonia Migrans").—This form of pneumonia is met with quite frequently. The symptoms are those common to lobar pneumonia, as chills, fever, and the usual physical symptoms of a consolidated lung in this condition. The name is derived from its tendency to spread from lobe to lobe. The infection usually commences in one lobe and spreads to the second, to the third, and frequently when the crisis has taken place the disease commences with full force in another lobe and may continue so for several weeks. That this form of pneumonia is very

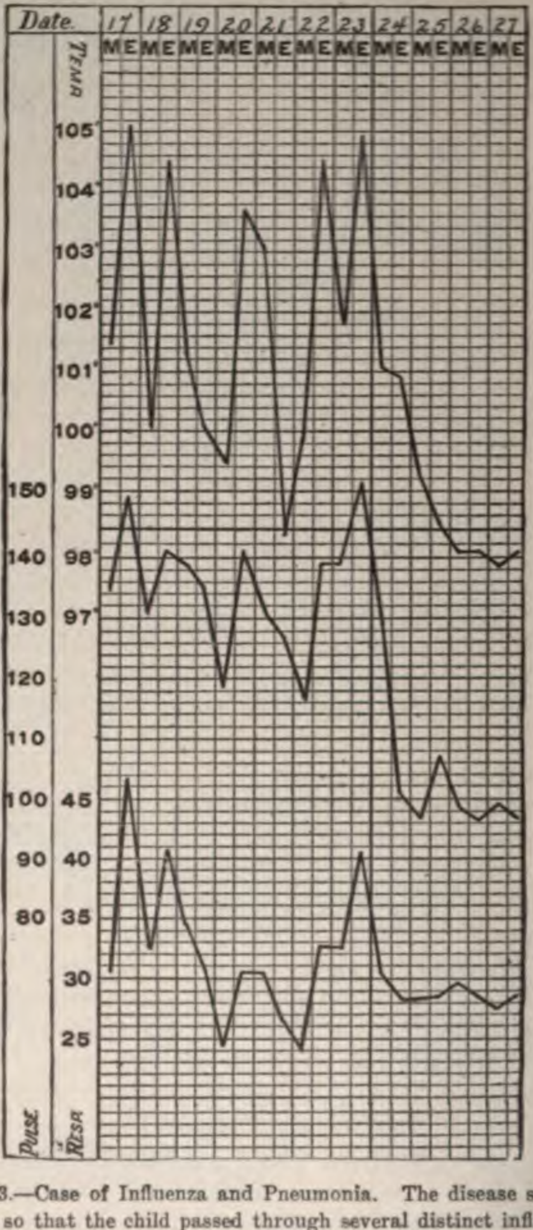

Fig. 153.—Case of Influenza and Pneumonia. The disease spread from lobe to lobe so that the child passed through several distinct inflammations. This form is known as *Pneumonia Migrans (Wandering Type)* Careful dieting aided by stimulation, and the fever treated by cold compresses and cold colon flushings aided recovery. (Original.)

serious can be easily imagined. A child having suffered with acute lobar pneumonia and passed its crisis with an already weakened heart, and has again to pass through the second pneumonia and frequently through a third and a fourth, must certainly have great vitality in order to recover from the depression caused thereby.

The depressing effect on the heart from a continued fever in addition to the toxæmia must be taken into account in giving the prognosis; hence it is safe to assume that the prognosis in every pneumonia migrans is necessarily grave. Stimulation, which is so urgently called for in the usual form of lobar pneumonia, is imperative in this variety of the disease.

Cerebral Pneumonia.—This type of the disease is one which is very frequently met with in which the symptoms of pneumonia are chiefly complicated by meningeal symptoms; thus clonic spasms or convulsions are usually present. In addition thereto there is vomiting, constipation, headache, opisthotonos, delirium, stupor, irregularity of the pulse, and, later on in the disease, coma. In some cases paralysis is liable to occur.

TWO INSTRUCTIVE CASES OF CEREBRAL PNEUMONIA.[1]

CASE I.—Baby E., about six months old, a nursing baby, was seen by me in January, 1902, in consultation with Dr. Osias. The history was as follows: The child had been ill for several days, was restless and feverish, and had vomited. The stools were greenish and contained a large quantity of cheesy curds, in addition to mucus. The abdomen was slightly retracted, the extremities were cold; there was no œdema present. The child did not seem to take the breast very well and vomited frequently after nursing. The temperature was $102\,^4/_5$° F., per rectum, pulse 140, respiration 44. Unilateral spasms with twitchings of the muscles of the shoulder, arm, leg, and foot were constantly present. Twitchings of the muscles of the eye and a constant rolling of the eyeball were noticed; the head was thrown backward; the muscles of the neck were rather rigid, although there was no distinct opisthotonos. The spasms were confined to the right side of the body; the knee-jerk at the patella was absent on the right side; the plantar reflex on the right side was slightly present; the patellar reflex was normal on the left side and the plantar reflex was more distinct; the pupils responded very sluggishly and were unusually large; this dilatation of the pupils persisted through the whole illness, until convalescence was established. The examination of the thorax showed intense pulmonary congestion; there was slight resistance on percussion and marked dullness. Judging from the ratio between the pulse and the respiration, the diagnosis of pneumonia was hardly possible. The physical signs on auscultation showed bronchial breathing and a distinct crepitant râle. The diagnosis of cerebral pneumonia was made, although meningitis *per se* was excluded.

The treatment was directed to relieve the pneumonic infection. Expectorants, in addition to inhalations of steam, were ordered. Cold compresses were used as antipyretics, and castor-oil or calomel was given to cleanse the gastro-intestinal tract. The disease progressed; the temperature increased and rose to $103\,^4/_5$° F. on the following day, and to $104\,^2/_5$° F. on the third and fourth days. With the rise of temperature the pulse-rate was increased to 140°, respirations to 52. On the fifth day of the disease there was a marked somnolence, stupor and partial coma. The head now showed a distinct opisthotonos; the sterno-cleido mastoids were very rigid; the pupils were both dilated and the convulsions continued as before. Leeches were applied over the mastoid portion of the temporal bone to relieve the cerebral congestion; the scalp was shaved and iodoform collodion, 10 per cent., was painted on the occiput; ice-bags were applied over the whole of the cranium as well as to the nape of the neck, mustard foot-baths were frequently given and afforded some relief during the severe spasms. An enema consisting of chloral hydrate and sodium bromide, 5 grains each, with 1 ounce of starch water, was ordered. This was to be repeated every three hours until the spasms ceased. Before injecting the above drugs both the rectum and the colon were flushed with soap-water enema.

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[1] Reprinted from Archives of Pediatrics, February, 1903.

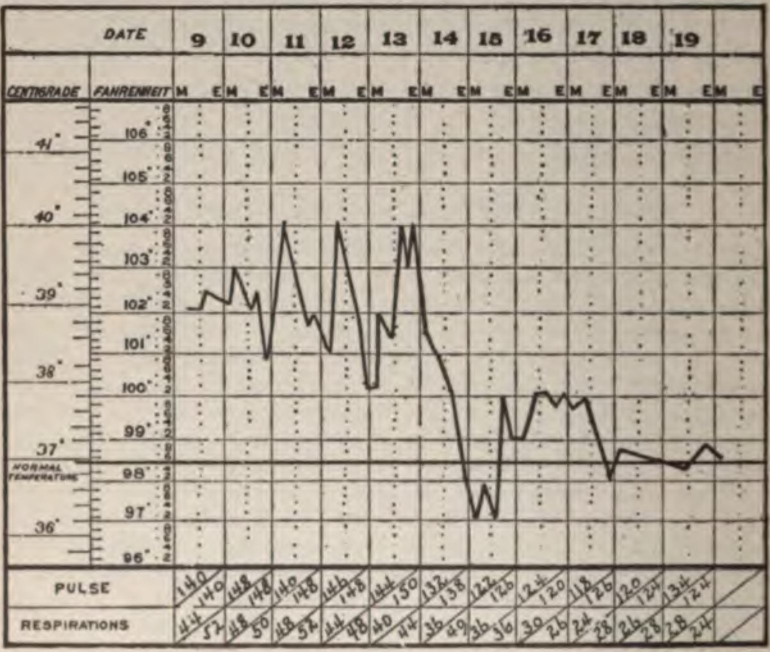

Fig. 154.—A Case of Cerebral Pneumonia. (Original.)

On the seventh day of the disease there was a distinct crisis, inasmuch as the temperature dropped from 104° to 97°, a drop of 7 degrees. (Fig. 154.) Stimulating expectorants were then ordered in the following manner:—

℞ Ammon. carb.	15 grains
Syrup. pruni virgin.	4 drachms
Aquæ camph. q. s. ad	2 ounces

M. Half a teaspoonful every two hours.

The child's convalescence continued. The pneumonia completely subsided; resolution set in; the spasms, which had been so disagreeable and persistent, also stopped. The child commenced to show signs of consciousness, played, laughed, and cooed; the stools, which had been so greenish and curded, assumed a more natural yellowish color and pasty consistency. The appetite seemed to return; the infant nursed better, the nights were more comfortable, and the child slept from one feeding time until the next.

Several weeks after the child's recovery, on February 27th, a local inflammatory condition was noticed. The child's temperature suddenly rose to 102° F. and on February 28th the temperature was 104° F., pulse 120, respiration 28. (Fig. 155.)

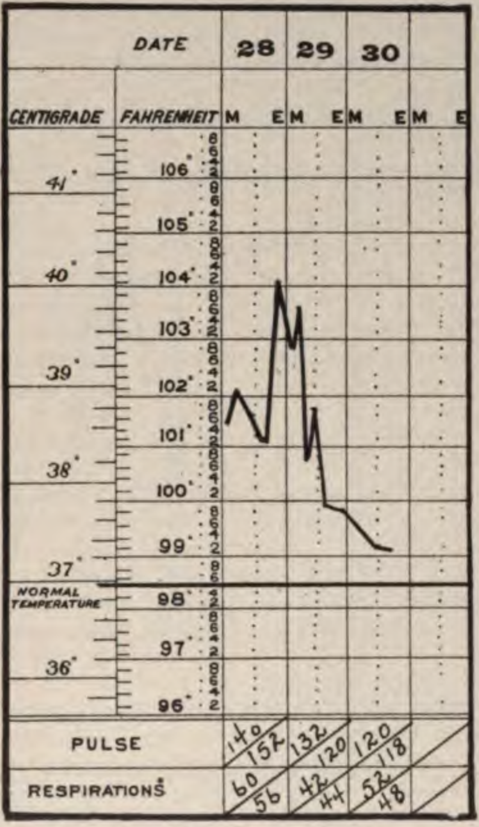

Fig. 155.—Showing Secondary Fever During Convalesence from Pneumonia. (Original.)

The physical examination of the thorax showed both lungs normal. No pathological lesion could be detected, so that the lungs were excluded as a cause of this sudden febrile disturbance.

Empyema was suspected, but nothing pointed to this condition. After excluding the stomach, liver, intestines, spleen and other organs as a probable cause of the fever, there remained but one thing to note; viz., swelling of the neck due to enlarged nodes. There was regurgitation of fluids through the nostrils. As the child cried while nursing, dysphagia was suspected. In the throat on the right side a swelling was detected which gave evidences of fluctuation and which proved to be a retropharyngeal abscess. The external lymph nodes were very much swollen. The abscess was incised and the child made an uninterrupted recovery.

Malt extract and codliver-oil in addition to other restorative treatment was given. Iodide of sodium was given in two to three grain doses several times a day and seemed to exert a very marked effect on the swollen pharyngeal mucous membrane.

Case II.—Hannah T., 7 years old, was taken sick with fever, complained of being tired, and was very thirsty. She had anorexia and was inclined to constipation. She also complained of headaches. When first seen by me her temperature was 103.4° F. in the mouth, the pulse 168, respiration 34. She had a very coated tongue; the throat was dry, there were no patches visible. There was no history of exposure to contagious diseases; a gastric catarrh was suspected. The respiration and pulse ratio suggested a pulmonary complication.

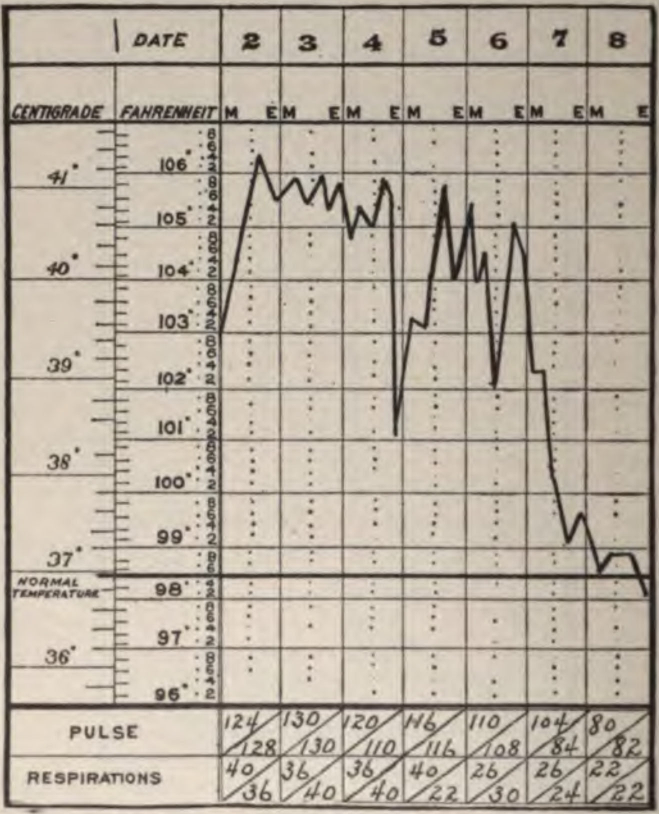

Fig. 156.—Cerebral Pneumonia with High Temperature and Marked Decrease in Temperature After Cold Baths. (Original.)

The physical examination of the thorax gave no evidence of consolidation, merely roughened, harsh breathing, some rhonchi and slight resistance on percussing the right apex anteriorly. No diagnosis except "fever" was made. I ordered calomel 1 grain with powdered rhubarb 3 grains. Citrate of magnesia was given for the thirst. A fluid diet, consisting of equal parts of Seltzer and milk, with sponging of the chest with alcohol and water every hour, and cool cloths, moistened with evaporating lotions like bay rum or Florida water, to the forehead were also ordered.

I examined a specimen of urine which contained nothing abnormal. On the following morning, twelve hours after my first visit, the temperature by rectum was 104.4° F., pulse 172, respiration 68 while asleep. The bowels had been thoroughly cleaned, still there was no evidence of pneumonia, but the child seemed to be greatly depressed. There was marked apathy; the child was very restless and had not slept. Constant twitchings of the muscles of the face and extremities occurred; the child cried out while in the stupor, refused food, attempted to bite and screamed loudly. The patellar reflexes were both present, the pupils reacted normally, the head was not retracted nor were the muscles rigid. There was no opisthotonos; the child could be roused by loud talking, or by being touched. The temperature in the evening was 106.2° F. by rectum, the pulse 124, respiration 40. One drop doses of tincture of aconite were given every hour for eight hours and had no effect on the temperature, but did seem to reduce the pulse-rate and steady the heart's action.

The cold pack was ordered, to be renewed every half-hour until the temperature dropped to 102° F. Freshly prepared spiritus mindererus, one-half teaspoonful every half-hour until the temperature remained at 102° F., was also ordered. Warm mustard foot-baths were ordered to stimulate the circulation, and whisky with milk (ʒj to ℥iv), whenever possible. No distinct evidences of pneumonia were obtained on auscultation or percussion.

The temperature continued to rise, until 106° F. was reached. Dry cups were applied over the posterior portion of the lungs, also an ice-cap to the head. Colon flushings with water at a temperature of 60° F. were also ordered, to be repeated every three hours. These seemed to have a very soothing effect on the nervous system. The child was much quieter after them and the temperature was gradually reduced.

Frequently after a cool tub bath, combined with a cold pack, the temperature dropped three to four degrees. (Fig. 156.) Creosote carbonate, in 3-drop doses, was ordered every three hours, to be given in milk, soup or chocolate. This dose was increased gradually by the addition of one drop each day, until the child received ten drops every four hours. No systemic disturbance was noticed, there was no discoloration of the urine and no toxic symptoms resulted from the creosote treatment. A decided antithermic effect without cardiac depression was noticed. (A convenient way of giving the creosote is to add the drops to some Tokay wine or to combine it with whisky and water.)

Creosote steam inhalations were also ordered. Beechwood creosote, about a teaspoonful to a pint of boiling water, was permitted to steam on a table several feet from the patient. This powerful vapor soon impregnated the air so that the creosote could be smelt throughout the whole apartment. It certainly acted very well, not only on the temperature but also in loosening viscid secretion.

The vital point in the treatment consisted in giving a supporting diet of eggs beaten up with sugar and Tokay wine, concentrated soups, and milk pre-digested with peptonizing powder. Malt extract was given as a restorative and also for its diastasic effect. The treatment was continued until the child's temperature remained normal for several days, when all forms of creosote were discontinued.

It is interesting to note that very great depression of the nervous system, violent twitchings of the muscles and talking aloud while asleep, continued for several weeks after convalescence was established. The child slept at least twenty hours out of the twenty-four for fully one week. It was at times difficult to arouse her to take nourishment. This great stupor was evidently due to the profound toxæmia which existed. The urine, which was frequently examined, showed an excess of phosphates, gave a strong diazo reaction, contained neither albumin nor sugar. The child was discharged after eight weeks and is in good health to-day.

The following symptoms were the most noteworthy in the cases reported:—

(*a*) Unilateral spasms, twitchings of the muscles of the shoulder and the arm, and of the leg and foot, were constantly present. (*b*) Twitchings of the muscles of the eye and a constant rolling of the eyeball. (*c*) The head was thrown backward. (*d*) The patellar reflex was absent on the affected side. (*e*) The plantar reflex was slight on the affected side. (*f*) Distinct evidences of pneumonia, bronchial breathing and marked dullness on percussion. (*g*) Convulsions and marked stupor later in the disease. (*h*) When the crisis appeared in the pneumonia, the cerebral symptoms subsided. (*i*) Marked nervous depression and extreme hyperæsthesia of the body, which continued for weeks after all inflammatory symptoms had subsided.

Schlesinger, in studying this disease, noted that it existed chiefly in children between the third and sixth years.

In acute apical pneumonia we usually note cerebral symptoms due to the irritation of the cervical ganglion. These symptoms subside with the crisis of pneumonia. They must not be confounded with meningitis, which is a distinct disease, although a frequent complication of pneumonia.

Symptoms and Course.—The disease is usually ushered in with convulsions. At times vomiting and diarrhœa may be the first symptoms noticed. Chills are very rarely seen in children. The cheeks are usually very red and show the characteristic flush so well known in adult pneumonia. The respirations are increased, the pulse is accelerated, and the temperature rises. One of the most important diagnostic points and one upon which I lay great stress is the *"ratio between the pulse and respiration."* Normally the ratio is 1 to 4, and when this ratio is increased, as, for example, when there are 60 respirations and 140 pulse beats, then the ratio of 1 to 4, which normally existed, is certainly disturbed. By this disturbed ratio alone we can frequently make a diagnosis by the process of exclusion. Especially is this true in those cases of "central pneumonia" in which the disease develops in the center of the lung and gradually spreads toward the periphery. When such central pneumonia exists, the physical signs will be so masked that bronchial breathing will be hardly discernible. The temperature will suddenly rise to 102°, 103°, and frequently to 105° F. The temperature in rachitic children will sometimes rise to 106° and 107° F. It is this class of cases that show the most severe form of depression from irritation of the thermic centers. In these rachitic children we usually note that the invasion of pneumonia begins with a convulsion or a series of convulsions.

Children old enough will frequently complain of abdominal pains. Thus we must not be misled by gastric or gastro-intestinal symptoms until we can exclude the lungs as the seat of the disease. The physical sign most commonly associated with this disease is dullness on percussion over the affected area of the lung. In addition thereto there will be bronchial breathing. If the child cry, a loud bronchophony will be heard. There will also be an increased vocal fremitus. These symptoms usually remain the same for a few days, although they may increase in intensity.

Between the sixth and the ninth day, rarely earlier and very rarely later, a crisis takes place in which the temperature will suddenly drop to normal. The patient will be covered with a profuse perspiration; the pulse, which formerly was full, bounding and accelerated, will be found smaller and less frequent. The former flush which existed will give place to a distinct pallor of the skin, and the observing physician will note a decided change in the patient. This condition, known as the crisis, may come on suddenly or gradually. In some cases the fever drops slowly—*i.e.*, by lysis, until normal is reached.

Pulse.—The pulse-rate is one which is a very important factor in connection with this disease. While it may be 120 and be quite regular in action, it is not uncommon to find the pulse-rate 140, and even 160. The frequency of the pulse is not as important a factor in determining the progress of this disease as is the character of the pulse. Thus, to illustrate, if a pulse is not frequent, but is weak and arythmic, such a patient should be regarded as in imminent danger and requires very frequent and careful stimulation. A condition of collapse may be looked for in such a patient, and treatment directed to the prevention of the same is indicated. If the pulse-rate has been 120, and it suddenly increases to 140 or more, then some complication must be suspected and the child carefully examined to determine the cause of this sudden increase of the pulse-rate.

Respiration.—The whole respiratory condition is superficial and seems to call the accessory respiratory muscles into play. When the respiration is above 40 per minute, the diagnosis is usually very positive.

Lack of Expansion.—A lack of expansion may also be noticed. It involves the whole of the affected side and is not limited to the subclavicular region. In pneumonia this lack of expansion in the subclavicular region is marked, even though the inflammatory process is situated at the base. It can be observed as early as the first day, and lasts throughout the entire course of the disease. This early appearance of the sign is of especial importance, since the physical signs of involvement of the lung are so frequently delayed in cases of infantile pneumonia.

The sign is best elicited in the dorsal position, and is easily seen on the exposed chest in quick respiration.

One writer says he has recognized by this sign alone pneumonia occurring in a supposed case of appendicitis, and also has discovered pneumonia complicating typhoid and influenza.

The Temperature.—A rise of temperature usually implies the invasion of the specific micro-organism and hence is one of the earliest symptoms of this disease. It usually rises from 102° to 105° F., and remains so until the crisis. There is, however, a morning remission; thus we find the temperature about one degree lower in the morning than we do in the evening. In pneumonia we frequently find a condition known as the "procrisis." This procritical stage exists one day before the crisis, as a rule. The temperature will suddenly fall to normal on the day preceding the crisis. It has a valuable prognostic significance, showing that the inflammatory stage has now terminated.

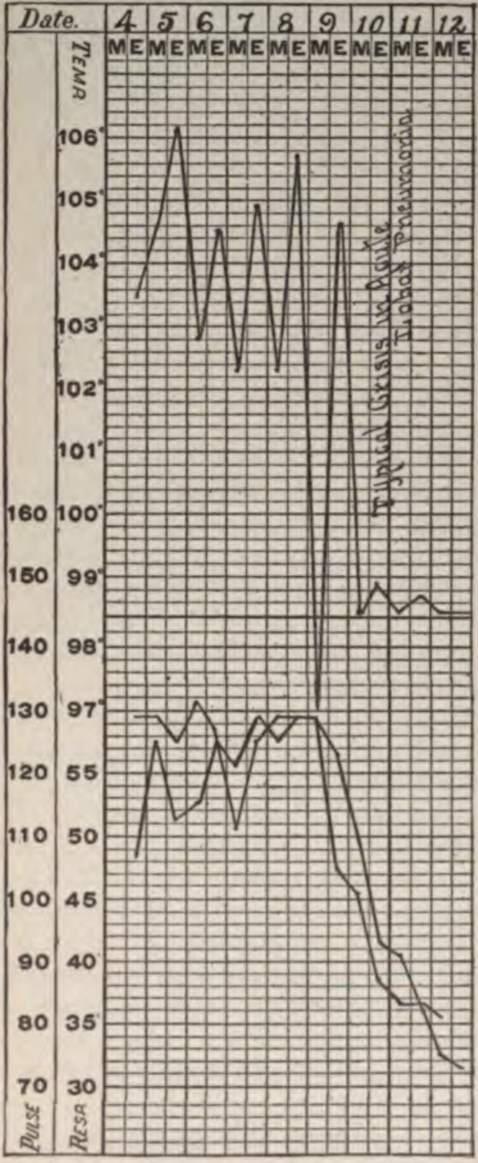

Fig. 157.—Lobar Pneumonia of a Severe Type, seen by me in consultation with Dr. S. M. Landsmann. The effect of the poison is easily seen by studying the pulse-rate. Case Recovered. *(Original.)*

The Blood in Pneumonia.—Baginsky maintains that the examination of the blood will show the progress of this disease, and he believes that the leucocytosis so common in this disease has an important bearing on the prognosis of this condition. Felsenthal and Schlesinger, also Monti, Berggrün, and Loos, have found that there is an increase of the polynuclear cells, whereas the eosinophile cells disappear. When the temperature returns to normal during the crisis in pneumonia, the leucocytosis which formerly existed also disappears. Thus some authors speak of a "blood crisis."

The Urine.—This is frequently high-colored and very scanty, especially so during the height of the disease. It also has a very high specific gravity and frequently contains albumin. Acetone can also frequently be found in the urine. The albumin frequently disappears after the crisis. The phosphates seem increased, though some authors maintain that they are decreased during the progress of this inflammatory type of disease. The diazo reaction is only found in that form of pneumonia which seems to have a typhoid tendency. Indican is very rarely or never found unless there is some form of intestinal putrefactive complication.

Relapse.—It is not infrequent to have one and the same area of lung reinvaded; thus the disease may run a second course over the same portion of the lung just as it did in the first attack.

Diagnosis.—The diagnosis of pneumonia is easy when the physical symptoms of dullness on percussion, bronchial breathing, moist râles, and bronchophony are shown. These symptoms are not always present and are frequently absent during the first few days of the disease. The diagnosis can be made by the disturbed ratio between pulse and respiration, as previously noted. In addition thereto, the peculiar character of the respiration, added to the cough, will certainly aid in establishing the diagnosis. The vital point to remember is that normally, bronchial breathing is heard posteriorly between the scapulæ and also in the regio supraspinata dextra. We must also remember that dullness on percussion appears somewhat higher on the right side posteriorly in the lower lobe than on the left side. The positive diagnosis can therefore only be made by noting the physical signs in the lungs and excluding the symptoms pointing to a gastric catarrh, to a typhoid fever or a meningitis.

Atalectasis pulmonum can easily be differentiated from pneumonia by the absence of fever and by the marked difference in the dullness on percussion and usually by the absence of bronchial breathing. When fever recurs after it has apparently terminated, some complication must be suspected. Symptoms pointing to a pleuritic effusion are, dullness on percussion and diminished respiratory murmur over the affected area. Gangrene of the lungs can usually be detected by the odor of the breath and the associated condition of collapse. If the condition assumes a chronic type and is associated with headache and fever, and if the child, in addition, commences to emaciate, then we may suspect the development of tuberculosis. To render such diagnosis positive, some of the sputum or expectoration should be examined for the presence of tubercle bacilli, the presence of which will establish the diagnosis. The absence of tubercle bacilli in the sputum does not necessarily mean that tuberculosis is absent.

The Prognosis.—The prognosis of croupous pneumonia is relatively good. Out of 173 cases reported by Baginsky, of Berlin, 4 per cent. died. These latter children were very poorly nourished.

Fatal cases may be expected in bottle-fed infants rather than in breast-fed infants. An abnormally developed thorax so common in rickets, has an important bearing on the prognosis of this disease. Pigeon-breasted and narrow-chested infants having an improperly developed lung space, are more prone to a fatal termination.

The development of symptoms of tuberculosis or abscess of the lung or the extension of a pneumonia and the continuation of the same, will mean a depression of the heart's action and an inhibiting of the recuperative tendency. The vital point will be the question of nutrition. The greater the amount of food taken the better will be the chance for the patient's recovery; thus the maxim in treating a pneumonia, "Feed the stomach," is one that I have learned to indorse and verify.

Treatment.—The most important symptoms to be remembered in the treatment of this disease are the condition of the heart, the pulse-rate, the respirations, the temperature, and the condition of the kidneys, to be noted by the quantity and the quality of the urine secreted.

Isolate the Child.—As lobar pneumonia is an acute infectious disease caused by the invasion of the pneumococcus, it is transmittible. Our first duty is to isolate. A case of pneumonia should be isolated as strictly as a case of diphtheria. All healthy persons should be excluded, be they friends or family. It is best to let them know that this disease can be disseminated.

In the treatment of pneumonia we must remember that toxæmia and high temperature will produce degeneration of the muscular fiber of the heart, which, if prolonged, will result in heart failure. Hence our treatment must be directed to lowering the temperature and to control the inflammatory process before stagnation of the blood and hepatization have taken place, thus aiming to retain the integrity of the respiratory tract.

Any interference with the proper action of the respiratory apparatus leads to overloading and ultimate failure of the right side of the heart. Hence we must seek to keep up the respiratory pump by lessening the frequency and increasing the depth of the respirations.

A great many cases will get well without treatment. This is called the "self-limited" condition. The disease simply runs its course, and if the patient is properly fed, strengthened, and guarded, a favorable termination may be expected. On the other hand there are certain symptoms which demand treatment. For example, hyperpyrexia will require treatment, especially so, as the continuation of the same may be the means of developing disturbances resulting in convulsions. My preference has always been for the use of cold externally. If cyanosis exists then warm flaxseed poultices may be tried.

The sudden application of cold externally causes a deep inspiration and consequent forcing of air through the alveoli, thus preventing atelectasis. The air surrounding the child should be kept moist with steam from a tea-kettle, having a long spout directed toward the child (Fig. 137).

The following case was attended by me in the babies' ward of the New York Post-Graduate Hospital:—

Child F. A., 5 years old. My attention was called on August 12th to a temperature of $99^{2}/_{5}$° F., which rose to $104^{3}/_{5}$° F., by 8.30 the following evening. Percussion showed dullness over a complete lobe of the left lung, bronchial breathing, cough, no expectoration. The respiration rose from 36 in the morning to 50 in the evening, and the pulse from 120 to 130 per minute. Until the diagnosis was positive the child was put on the expectant plan of treatment. The temperature rose to 105° F. on the second day, in spite of sponge baths consisting of equal parts of alcohol and water. After a few hours the temperature increased to its former height, sometimes going beyond that, prior to the sponge bath.

In order then to have a more lasting effect, it was deemed necessary to give the tub baths, that is, to immerse the child from the neck to the feet in water of about 90° F. and then adding ice until the temperature of the bath is 70° F. The child was kept in the bath from two to five minutes.

The first tub bath brought the temperature from $104\,^{2}/_{5}$° F. to 100° F. This drop lasted about two hours. The temperature did not rise more than two degrees until the following afternoon at 4 P.M., when it reached $104\,^{4}/_{5}$° F. This is a natural course in a severe pneumonia. The second tub bath had the effect of lowering the temperature from $104\,^{4}/_{5}$° F. to $101\,^{1}/_{5}$° F., a decrease of $3\,^{3}/_{5}$° F. in one hour.

On the 19th of August, the eighth day of the disease, the temperature reached $104\,^{3}/_{5}$° F. at 6 P.M. A tub bath given brought the temperature to 103° F. at 7 P.M., a fall of $1\,^{3}/_{5}$° F. in one hour. This same temperature continued until 9 P.M., after which it began to fall, reaching normal on the following day, the ninth day of disease. The boy was discharged cured. He was entirely well when I last heard of him.

In the above case, true symptomatic treatment was carried out. The severe cough received an expectorant with an anodyne (codeine) when necessary to relieve pain. Bowels and bladder were carefully watched. Stimulants given when required —no antipyretics. Diluted milk and whey, every three hours. Cool water whenever thirsty.

Drug Treatment.—When high fever persists in a weakened child with very low resisting power, such fever must be reduced. The child's system must be carefully watched while fever is in progress. One child will tolerate a temperature of 105° F., laugh and play, and take its food regularly, while another child in a similar pulmonary condition will show extensive cerebral irritation, somnolence, tremor, twitching of the muscles, and possibly convulsions at a temperature of 103° or 104° F. In the latter instance it shows that the poison from the pneumococcus infection has overwhelmed the nerve centers governing heat production, and in such instances when decided nervous or cerebral symptoms present themselves, "a reduction of temperature is demanded," or we must not be surprised to see convulsions set in, with probably a fatal termination.

How Shall We Reduce the Temperature in Children?—When we consider that antipyretic drugs depress the nerve centers governing heat production and increase the work of the emunctories, already loaded down by poison brought to them for elimination, it can be seen that their use is contraindicated. Those who believe in phagocytosis may be reminded that antipyretics arrest the development of leucocytosis, and thus remove one of the means of destroying the germs of the disease according to one theory, or the antitoxin generated or developed according to another (Hobart A. Hare).

Jacubowitsch and Muller and many others have proved conclusively that antipyrine decreases the elimination of urea by the urine. It also decreases the urinary flow, which is a very harmful effect, when we consider the great importance of eliminating effete matter from the body. That antipyretics depress the heart's action is only too well known, therefore, rather than to combine them with musk, camphor, or other cardiac stimulants, I have discarded them.

When drugs are used as antipyretics the coal-tar products are usually the ones suggested. Lactophenin, antipyrine, phenacetin, salol, salipyrine, and quinine are among the more common antipyretic measures used. The tincture of aconite, in 1-minim doses, repeated every hour, has a remarkably good effect on this disease. In addition thereto, spirits of mindereri in half-teaspoonful doses, repeated every hour, will have a very good diaphoretic effect. Dover's powder will relieve cough and will also aid diaphoresis.

For difficult breathing nothing will serve as well as local depletion. For this purpose the application of dry cups over the affected areas of the lung will afford in some instances immediate relief. Dry cupping may be repeated in severe dyspnœa in twelve hours if necessary. Tincture of iodine applied locally over the area of the lung affected will also be advantageous in some instances.

If convulsions persist an ice-bag applied over the head and also at the nape of the neck will be very valuable.

I frequently use one or two leeches applied over the mastoid process of the temporal bone and permit very free bleeding. This is especially indicated when there is intense engorgement of the brain with marked stupor and coma. We can frequently *relieve congestion* by the application of leeches to the alæ nasi. A simple but most effective remedy is the use of mustard foot-baths frequently given.

To relieve the cerebral hyperæmia, calomel in $^1/_{10}$-grain doses, and increased, may be repeated until liquid stools have been produced. It is one of our most valuable remedies and should be used at the onset of a suspected pneumonia. Attention to the stomach and bowels will frequently be the means of saving the life of the patient. I insist upon a loose condition of the bowels, and if the same cannot be produced by the administration of calomel, then an enema should be given by flushing the colon as often as once in twelve hours to cleanse the parts. When children are old enough, then one of the most valuable remedies is to give copious drinks *of citrate* of magnesia. This will not only quench the thirst, but will act *as a laxative,* and in addition thereto stimulate the secretion of urine.

We find therefore that the emunctories require especial stimulation and attention during the course of lobar pneumonia.

In no disease is strychnine more valuable than during the course of pneumonia. Very small doses of only $^1/_{200}$ or $^1/_{100}$ grain, repeated every hour, may be given without fear during the progress of this disease. The question of stimulation is one of individuality. Each case must be treated on its own merits and the individual condition studied. When the heart's action is feeble and the pulse is thready, whisky must be given. In some cases five to thirty drops of good whisky may be given as often as every half-hour until the pulse responds to the stimulant. I frequently combine strychnine with whisky. In other cases champagne in half-drachm or drachm doses will be found far more effectual. Some children object to the taste of whisky or champagne, but will take a sweetened wine. In such cases give good, old Tokay in half-drachm doses as often as is required. When there is an aversion to the taking of medicine or if the child rebel against stimulation by the mouth and it is urgently called for, then half a teacupful of hot water, temperature of 100° F., to 105° F., to which a teaspoonful of either whisky or alcohol is added, may be thrown into the colon by means of a colon tube. Hypodermic medication must not be overlooked, and frequently it is wise to use whisky, ether, or spirits of camphor. A valuable method of giving camphor hypodermically is by injecting camphorated oil, from 5 to 15 minims. Musk is one of our best cardiac stimulants, and if the pulse-rate is feeble it may be given in 1 to 5-drop doses, repeated in three or four hours, if necessary.

Hygienic Treatment: Room Temperature.—One of the most important factors is the regulation of the temperature of the room. Every child having a pneumonia should be put into a room having a temperature of 65° to 70° F. An equable temperature should be maintained, as the same is very grateful during the febrile stage of this disease. Fresh air should always be admitted.

Oxygen.—When severe dyspnœa occurs and if cyanosis exists, then oxygen inhalations may be required. Under these conditions several respirations should be given every few minutes until the lips lose their cyanotic appearance and again have their natural color.

Sponge Baths.—The surface of the body should be sponged with tepid water every day. Equal parts of alcohol and water are grateful to the patient, and should be used every hour if the temperature requires it. If, however, the temperature is not high, then a sponge bath to which a little alcohol has been added will be grateful, and may be given every morning and evening.

Another valuable means of reducing the temperature is by sponging every hour with acetic ether. This must be cautiously used, owing to its volatile and inflammable tendencies.

The Oil-silk Jacket.—This jacket is valuable when we desire a diaphoretic effect. It also prevents the chilling of the surface of the lung by maintaining a uniform temperature. The details of making this jacket can be found in the article on "Broncho-pneumonia," page 462.

Dietetic Treatment.—As previously stated, the prognosis in this condition depends on the amount of food the patient will take. A milk diet should be prescribed. Buttermilk, kumyss, zoolak, rice and milk, farina and milk, oatmeal and milk, and cold foods, such as cornstarch pudding, rice pudding, and tapioca pudding, are very grateful. If the child is very thirsty and is over 2 years old, ice cream may be permitted very sparingly. This is very grateful to the little patient, and if made from fresh cream is very nutritious. Concentrated soups, chicken broth, and veal broth may be permitted. So also calf's foot jelly, chicken jelly, albumin in the form of raw white of egg, to which some sugar is added, may be given. A soft-boiled egg or raw yolk of egg with sugar may also be given.

The interval between each feeding must be prolonged, owing to the subnormal condition of the digestive tract. If children are fed from the bottle, or if they are nursing babies, then they should be fed with a longer interval than previous to the time of this illness; for example, if the infant has been given the breast every three hours, it is a good rule to extend the nursing time to three and one-half or four hours, if it is possible. In this manner we will not only aid in the assimilation of the food, but frequently prevent stagnation of milk which had been previously taken.

Night Feeding.—The rule which governs the feeding of healthy children cannot be applied to children suffering with pneumonia. During the febrile stage large quantities of liquids are demanded. In order to overcome the cardiac depression good nourishment is indicated. A nursling suffering with pneumonia should be given the breast several times during the night. Bottle-fed infants may also receive some nutrition every three or four hours during the night. A favorable termination in this disease can only be expected when the depressed vitality is stimulated by nutrition.

Tuberculous Pneumonia.

There are four pathological conditions which illustrate the various stages of the disease; they are: first, a bronchitis with rhonchi scattered through the chest; second, small areas of consolidation or partial consolidation; third, complete consolidation with bronchial breathing, dull areas on percussion; fourth, excavation with cavernous or amphoric breathing.

In its early stages the disease resembles broncho-pneumonia.

Cavities are frequently found post-mortem. They are difficult to find in young children under 3 years of age. On the other hand, children over *8 or 9 years* have cavities which can be recognized as early as in the adult.

Holt states that "the reason why in infancy cavities are so seldom recognized during life, is because they are generally small, often centrally located, nearly always filled with thick pus or cheesy matter, and rarely communicate freely with the bronchi. On the other hand it is very common to find signs in young children which, if heard in adults, would be regarded as almost positive evidence of a cavity, although none is present. These signs are cracked-pot resonance and cavernous breathing. They are not usually due to bronchiectasis, since this condition belongs to chronic cases, and especially to older children, but most frequently to consolidation about a large bronchus superficially situated, viz.: below the clavicle, high in the axilla, and in the interscapular region. The wide area over which this broncho-cavernous breathing is heard is one of the most striking points of difference from the signs of a cavity."

Course.—There are two types of cases: First, rapid cases or those terminating very quickly; second, those assuming a chronic course (protracted cases).

1. *The Rapid Type.*—The pathological process is a bronchitis affecting the smaller tubes surrounded by areas of consolidation. These lesions are the same as are found in broncho-pneumonia. The temperature curve is frequently the same as found in broncho-pneumonia, ranging between 100° and 104° F. The areas of consolidation are more frequently found in the upper lobes. There is also broncho-vesicular breathing and bronchophony. Percussion note shows slight dullness. The cough may assume a paroxysmal character similar to whooping-cough. Convulsions and frequently meningeal symptoms, such as a slowness of the pulse or Cheyne-Stokes breathing, will show the extension of the disease to the brain.

2. *Those Assuming a Chronic or Protracted Course.*—The duration of this form of the disease may be between one and six months. Some cases may last but three months. This is the most common type of the disease seen. Cases are frequently seen following measles, whooping-cough, pneumonia, or diphtheria. Those cases I have seen ended fatally within three or four months. There is usually a slight improvement after the second or third week of this disease. The temperature falls and the physical signs seem to disappear. As a rule the disease reappears with more violent symptoms, and emaciation, fever, and sweating continue until the end. The temperature curve is not regular. In some cases it ranges between 99° and 101° F. Other cases will have a much higher temperature, the thermometer registering 104° F. frequently. Expectoration is rarely seen in young infants as they invariably cough and swallow the same. The breathing is usually labored, hence dyspnœa is almost always present. When we have Cheyne-Stokes breathing, or irregular breathing, with a slow pulse, then cerebral complication should be suspected.

CHAPTER V.

ACUTE TUBERCULOSIS (MILIARY TUBERCULOSIS).[1]

TUBERCULOSIS is a specific infectious disease caused by invasion of the tubercle bacillus. The disease is disseminated by the same.

Etiology.—Acute miliary tuberculosis is frequently seen in very young children. I have seen cases in bottle-fed infants under 1 year of age. It is also frequently associated with tubercular meningitis. As a rule it follows those diseases which devitalize the system, such as the acute infectious diseases. In prolonged diseases affecting the air passages, tuberculosis frequently follows.

Cows' Milk.—The majority of cases of tuberculosis are found in children brought up by artificial feeding. This implies that such children received cows' milk. The dangers of infection by or with the tubercle bacillus can usually be excluded inasmuch as nearly every woman boils the milk. The more modern woman of to-day, instead of boiling cows' milk, submits the food to a steaming process, either by using a sterilizer or a pasteurizer. The result is the same, namely, the destruction of pathogenic bacteria of all kind, including the tubercle bacillus. Such artificial feeding with cows' milk frequently results in gastro-intestinal derangement. Dyspeptic attacks rob the system of food required for the nutrition of bone, muscle and other organic structures. When such conditions persist then poor foundations are formed, resulting in rickets or marasmus. The tubercle bacillus easily gains entrance where subnormal conditions prevail, and secures a foothold that ultimately develops tuberculosis.

Woman's Milk.—Human milk is intended by nature for the nutrition of infants. It offers decided prophylactic substances to the nurslings, for example: the nursing infant is very rarely afflicted with diphtheria or similar infectious diseases. This is most probably due to the immunity conferred by human serum and the antibodies or bacteriolysins which the serum contains during the nursing period. This also accounts for the rarity of pulmonary tuberculosis in children reared on woman's milk. The value of human milk has frequently been noted by me while studying this question in a children's clinic patronized by people living in the most congested district of New York City.

The statistics of my cases of tuberculosis from the children's service of the German Poliklinik in New York City are very interesting. Five thousand children were examined at random for the presence of tubercular lesions. More than 4900 cases out of this number showed no sign of pulmonary disease; 1700 of these cases suffered with adenoids, pharyngeal disease, catarrh of the naso-pharyngeal tract, or infectious conditions due to poor ventilation and general unsanitary surroundings. The cases were taken in children from the first to the tenth year inclusive; 59 cases out of this whole number showed distinct evidence of pulmonary tuberculosis. Only 9 cases of this whole number showed the presence of tubercle bacilli in the sputum. The difficulty in procuring sputum was an obstacle in making more frequent examinations. Forty-three cases of this number had bone and joint tuberculosis in addition to evidences in the lungs. In two cases tubercular empyema was found. Five of these 59 cases had Pott's disease.

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[1] Tuberculosis of the bones, joints, and glands are described under separate articles.

TABLE No. 66.—*Table showing Manner of Feeding in 59 Consecutive Cases of Tuberculosis, among the Poor.*

Manner of Feeding.	*Number of Cases.*
Breast milk (human milk)	2
Cows' milk	37
Condensed milk	18
Modified milk (laboratory)	2

Tuberculosis in children is so closely allied to scrofulosis that a great many authors believe them to be identical. There certainly are a great many characteristics common to both. On the other hand a close scrutiny of the pathology of the disease will show them to be distinctly separate. That scrofulosis will frequently be the medium through which, later on, tuberculosis develops, is well known and recognized.

"In the tuberculosis of the new-born evidence shows that the maternal ovum may be infected from the mother, or by the paternal seminal fluid; later the embryo may be infected by the placental route or amniotic fluid when the mother is tubercular. These modes of infection, while theoretically possible and occasionally actually authenticated, are nevertheless extremely infrequent in practice. By whichever of the above-mentioned routes the bacillus has gained entrance to the fœtal organism, there is no doubt that it may invade it and remain latent therein for an indefinite period. Unless the bacilli are actually found within the tissues, it is extremely difficult to uphold the view that the infection has not been acquired after birth."

The influence of raw meat on the evolution of experimental tuberculosis has been described by Chantemesse and Cornil.

Richet and Hericourt published experiments showing the beneficial effects of raw meat in tuberculosis of dogs. Their observations were open to the objection that the quantity of meat given was not measured, and that the good effect obtained might have been due merely to the fact that the dogs preferred larger quantities of raw meat than they would have eaten of boiled. To exclude this influence the following experiments were made. Six couples of dogs, each of the same weight and appearance, were taken. One of each couple was fed with boiled meat to satiety, the other was given an equivalent quantity of raw meat. Both were inoculated in the vein of the leg with tuberculosis. The dogs fed with boiled meat died at intervals varying from three weeks to four months. The necropsies showed general tuberculosis, more or less voluminous caseous granulations, and advanced fatty degeneration of the liver. Those fed on raw meat were killed at the same time. They were all plump; they showed less numerous tubercles than did the others, and less voluminous and less caseous granulations. In another experiment a dog was inoculated with tuberculosis and given 750 grams daily of raw meat. He preserved his strength, weight, and healthy appearance. He was killed at the end of twelve months. The necropsies showed a small number of tubercles in the viscera and tubercular interstitial nephritis. He was on the way to recovery. Two monkeys were inoculated with tuberculosis. One was fed on the ordinary diet, and died at the end of 23 days of general tuberculosis; the other was fed on raw meat for 15 days before the innoculation, and lived for 49 days. Chantemesse and Cornil therefore conclude that the utility of raw meat diet in tuberculosis *consisted not in overfeeding, but in the anti-tuberculous quality of the diet.*

The transmissibility of tuberculosis by means of drinking milk from cows whose udders are tuberculous, is admitted by a great many authors.

Behring believes that milk infection remains latent for years and then develops tuberculosis. This he states accounts for the absence of the disease in very young infants.

Koch is authority for the statement that *"bovine tuberculosis is an entirely different disease from human tuberculosis, and cannot be transmitted from a cow to a human being."*

Westenhoeffer believes that caries of the teeth and inflamed gums, as seen during dentition, permit the invasion of the tubercle bacillus into the lymph channels of the neck, resulting in cervical, bronchial, retrosternal, tracheo-bronchial, and finally mesenteric tuberculosis.[1]

Chiari, of Vienna, and Freudenthal, of New York, believe that the retropharynx which harbors adenoids is the point of entrance of the tubercle infection. *This view has always been held by me, inasmuch as tubercular meningitis results most probably from an extension upward from the pharynx,* and downward, the infection enters through the cervical glands.

Contact of the delicate, perhaps abraded, skin or mucous membrane of the young infant with tuberculous sputum may result in inoculation, as has been repeatedly shown in connection with ritual circumcision.

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[1] *Berlin* Klin. Woch., February 15, 1904.

The interesting observations of Lehmann show that sucking the wound after the ritual circumcision of Jewish children has caused tuberculosis. Baginsky reports a case of the transmission of tuberculosis to the eyebrow of a child by a tuberculous person. That tuberculosis may be transmitted by the process of vaccination on the arm cannot be disputed.

There must be a certain disposition or predisposition to the development of this disease. Other factors which are prominent in this connection are poor hygienic apartments; rooms in which sunshine is absent and in which foul air stagnates will certainly lower the normal resisting power of any and all individuals. When a child has passed through an acute infectious disease which has already lowered its vitality, then an infection with tuberculosis is more easily accomplished. Among such diseases which predispose to the development of tuberculosis are whooping-cough and measles. The same is also true in exhaustive diseases which drain the vitality of children for a long time, as, for example, after a prolonged attack of summer complaint. The disease frequently accompanies the nursing period, hence even the youngest child may become infected.

Tuberculosis has so great a tendency to generalize itself in children that the question of the primary infection is not to be settled by the mere frequency of the lesions. The fact that children swallow their sputa is to be kept in mind. There is no question as to its infectiousness, while that of infected milk in the human species has not been absolutely demonstrated. Still's statistics show that in 25 cases taken consecutively, of children under 3 years, who did not expectorate, intestinal lesions were found in 19, while in a similar series, aged between 3 and 12, they were found in only 10: It would thus appear that autoinfection by the sputa in infants is a matter of serious importance.

Bacteriology.—The germ can be traced to the blood and also the cells of the blood-vessels. This has been proven through studies made by Doutrelepont, Lustig, Meisels, and Weigert.

Demme found this specific germ in pus exuding from an eczema; the same is true about pus in otitis. Tuberculous affections of the tongue, of the nasal mucous membrane, of the thorax and tuberculous swellings on the lips of young girls have been described by Volkmann. Primary tuberculosis of the thymus, of the heart, and of the vaginal mucous membrane have been published by Demme. A. Baginsky has described a series of cases of tuberculous perityphlitis, peritonitis, and enteritis. Tuberculosis of the testicles in children has been seen and observed by him. The so-called scrofulous inflammatory conditions of the joints and suppurative diseases of the bones, while being described as "scrofulous," are usually of a tuberculous nature. The internal organs suffer from the invasion of the tubercle bacillus in this connection. The lungs and the pleura, the pericardium and myocardium, the liver, spleen, and kidneys, the coverings of the brain, and the brain itself are frequently affected.

The question of the transmission of the tubercle bacillus is one that is still debatable. Thus Jani reports in Virchow's Archiv, Bd. 103, p. 522, that the seminal fluid of tuberculous persons contains tubercle bacilli. The cases of tubercles in the fœtus are described by Johne and Armanni.[1] Bang, Lehmann, Birch Hirschfeld, Rindfleisch, and Kossel are among those who have reported isolated cases of tuberculosis directly transmitted from parent to child. Hochsinger recently reported 3 cases which he describes as congenital tuberculosis. These cases were associated with syphilis, and he believes that this disease is far more frequently transmitted than is generally recognized. Thus it appears from the studies of Brandenberg, Lesage, and Wolff that the placenta is an exceedingly valuable culture medium for this specific micro-organism, and thus they account for the comparative freedom of the fœtus born to a tuberculous mother.

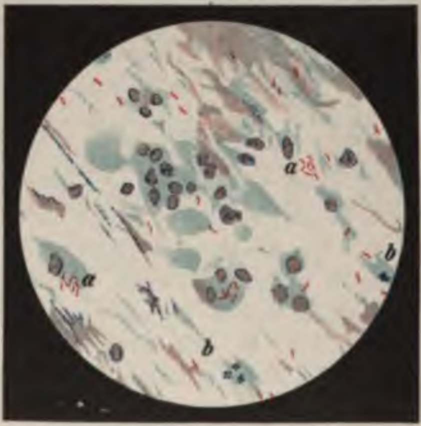

Fig. 158.—Tubercle Bacilli and Micrococcus Tetragenus (sputum). Gabbet's stain, Leitz ocular I, oil immersion $^1/_{12}$. *(a)* tubercle bacilli; *(b)* micrococcus tetragenus. (Lenhartz-Brooks).

Cornet and, more recently, Flügge made extensive investigations showing the means of dissemination of the tubercle bacillus. We are indebted to them for our knowledge regarding the danger of sputum of a phthisical patient, and also regarding the manner of transmission of this disease.

How susceptible very young children are can be shown by a case published by Wassermann,[2] in which he reports the transmission of tuberculosis to a child six weeks old by being in contact in the same room with a

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[1] Tenth International Medical Congress, Bd. 5.

[2] *Zeitschrift f.* Hygiene, p. 353.

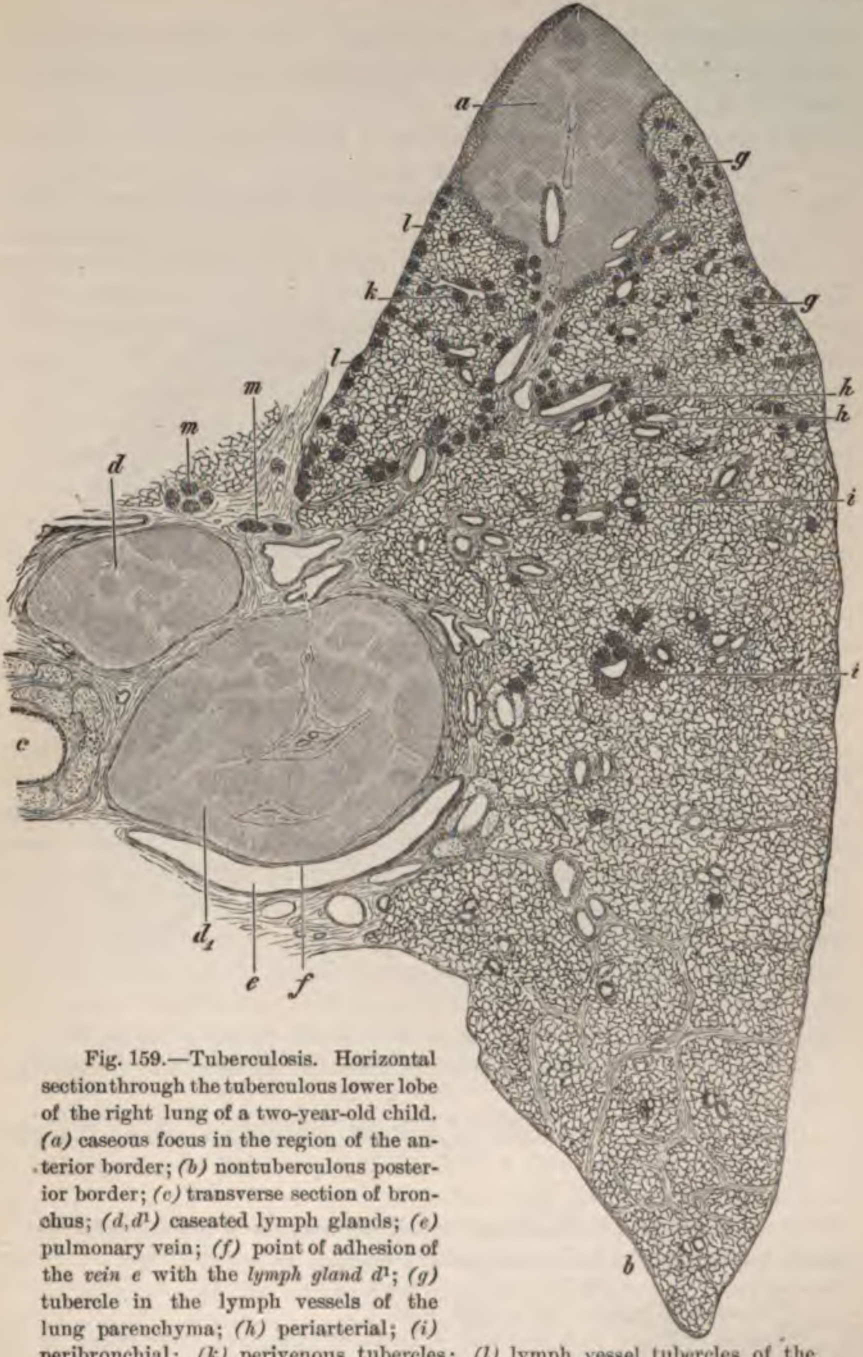

Fig. 159.—Tuberculosis. Horizontal section through the tuberculous lower lobe of the right lung of a two-year-old child. *(a)* caseous focus in the region of the anterior border; *(b)* nontuberculous posterior border; *(c)* transverse section of bronchus; *(d, d¹)* caseated lymph glands; *(e)* pulmonary vein; *(f)* point of adhesion of the *vein e* with the *lymph gland d¹*; *(g)* tubercle in the lymph vessels of the lung parenchyma; *(h)* periarterial; *(i)* peribronchial; *(k)* perivenous tubercles; *(l)* lymph vessel tubercles of the pleura; *(m)* tubercle in its connective tissue of the hilus of the lung. X3. (Ziegler.)

phthisical patient for eight days. Kitasato[1] reports the fact that tubercle bacilli die rapidly in the sputum, and he therefore does not believe the danger of the transmissibility of tuberculosis is as great as has been claimed. That contact with tuberculous patients is a very serious matter can be seen by a study of the literature..

Mother's milk has been closely studied and the possibility of infection through this channel cannot be denied.

Pathological Anatomy.—We are indebted to Bayle, Buhl, Laënnec, and Virchow for the division and study of the pathological anatomy of this disease. These authors divide the conditions into two distinct parts: First, cheesy pneumonia; second, the real miliary tuberculosis. By the cheesy pneumonia is meant that form of a chronic destructive process ending in cheesy necrobiosis. By the miliary tuberculosis is meant that form of disease commencing as a tiny nodular swelling, which starts in the connective tissue and is associated with the lymph bodies, having a tendency to form broken-down cheesy masses. The pathology of this disease can certainly be associated with no greater name than that of Virchow, to whom we are indebted for the bulk of our knowledge of this disease.

The tubercle is a small, grayish-white, translucent, sometimes yellowish body. The greatest masses consist of small, round cells about the size of a red blood-corpuscle, and large cells resembling epithelium. There are also giant cells. The giant cell, as a rule, can be found in the middle of these tubercles and is so closely identified with this condition that it has been looked upon as characteristic of this disease.

The growth of the tubercle consists in the development of new masses arising from the giant cells. In these giant cells there are no blood-vessels, and as there is no nutrition they easily break down and form what is later on the beginning of cheesy masses, which, by absorption and a melting process, are the real beginnings of cavities. At times these masses result in chalk deposits. The question of the specific origin of the disease has been finally settled by the investigations of Koch, who proved the specific microorganism known as the tubercle bacillus to be the pathological factor.

Biedert found 16 cases of primary intestinal tuberculosis among 3104 post-mortems.

Heller found 7.4 per cent. of primary tuberculosis among 714 postmortems in diphtheria, and a total of 19.6 per cent. of all varieties of tuberculosis among these 714 cases.

Orth states that primary intestinal tuberculosis is exceedingly rare in Berlin because of the universal use of sterilized or boiled milk.[2]

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[1] Zeitschr. f. Hygiene, Bd. 9, 1892, Heft 3.

[2] I have collected and described a series of important observations on the association of cows' milk with tuberculosis. The pathology of the cow's udder and *the milk ducts* are also described. (See chapter on "Cows' Milk.")

Baginsky reports that he found 8 cases of tuberculosis that died among 871 nurslings at his Berlin hospital. These were all under ten months of age. On the other hand he found, among 266 children in the second year, 13 died of miliary tuberculosis. One hundred and eighty-two children out of 611 died of miliary tuberculosis between the age of 2 and 4 years. Out of 152 children examined between the age of 4 and 6 years, 6 had miliary tuberculosis.

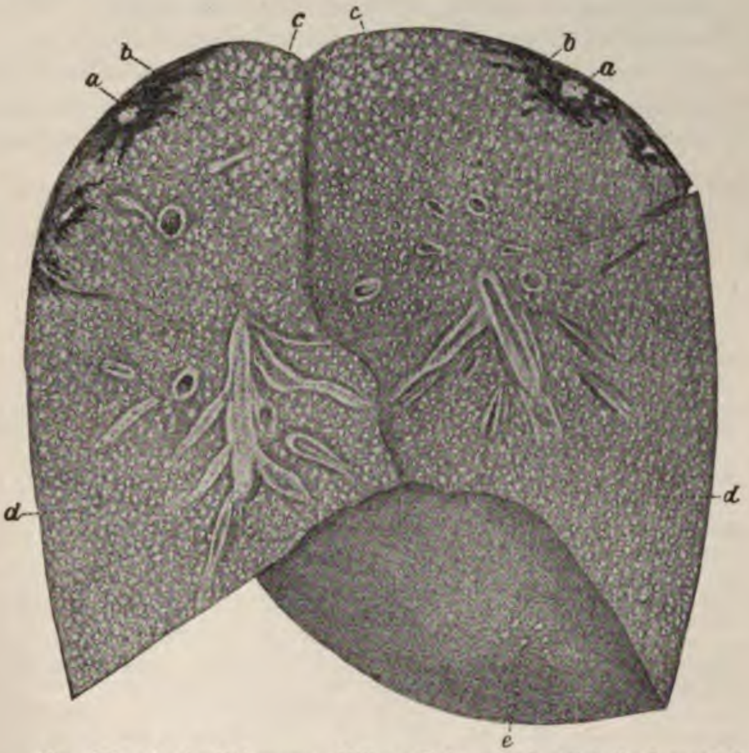

Fig. 160.—Acute Pulmonary Miliary Tuberculosis (Cut Surface of the Lung.) *(a)* so-called obsolete tubercle (old encapsulated caseous focus). ***(b)*** induration. *(c)* caseous, partly agminated nodules (transverse section of caseous bronchi.) *(d)* submiliary noncaseated tubercle in the true lung tissue. *(e)* tubercle of the pulmonary pleura. One half natural size. (Langerhans.)

Still[1] considers these facts and offers some interesting statistics, based, not on clinical observation, but on post-mortem findings, for the solution of this problem. In 769 autopsies of children, tubercle was found in 269, or 35.2 per cent. Tuberculosis was the actual cause of deaths in 252, or 32.8 per cent. From these statistics, therefore, it can be roughly estimated that about one-third of the deaths in childhood are due to tuberculosis in one form or other. While children are thus shown to be specially subject to this disease, they are not equally so at all ages, for Still shows that up to the age of 4 the percentage is as high as 71, and between 4 and 8 is still 22.5; after 8 it diminishes to 6.5. Moreover, the greater part of the tuberculosis under the age of 4—43.4 of the 71 per cent.—occurred in children under 2 years of age. This great frequency of tuberculosis in infancy has been used as an argument in favor of the idea of infection through milk, the primary lesion being in the digestive tract. It is true, Still says, that intestinal tuberculosis is exceedingly common in children; it existed in 52 per cent. of his cases examined, but so also is that of the brain and meninges —48 per cent.—and that of the lungs is far more frequent—78 per cent.

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[1] Clinical Journal, London.

Table No. 67.—*Deaths from Phthisis Pulmonalis (Pulmonary Tuberculosis) in Children Under 15 Years in Old New York City.*

		Total	0 Years.	1 Year.	2 Years.	3 Years.	4 Years.	Total Under 5 Years.	5 Years	10 Years.
1890	Males . . .	98	30	24	10	5	7	76	14	8
	Females .	145	31	23	12	7	2	75	25	45
1891	Males . . .	91	27	15	7	7	5	61	13	17
	Females . .	119	25	16	9	3	4	57	16	46
1892	Males . . .	109	32	29	15	6	3	85	17	
	Females . .	114	29	21	10	8	5	73	22	39
1893	Males	119	31	27	8	10	8	84	14	21
	Females . .	140	29	17	11	7	9	73	20	47
1894	Males . .	108	31	18	10	8	6	73	20	15
	Females	102	20	15	10	7	3	55	12	35
1895	Males	117	45	29	12	5	5	96	6	15
	Females . . .	122	26	27	6	7	3	69	18	35
1896	Males . . .	87	24	26	7	5	1	63	14	10
	Females . . .	113	21	15	13	5	3	57	18	38
1897	Males . . .	93	28	24	8	3	2	65	11	17
	Females . .	104	23	17	7	6	10	63	14	27
1898	Males . .	84	29	18	4	3	2	56	14	14
	Females . .	92	13	12	9	5	5	44	17	31
1899	Males . . .	110	37	16	10	9	5	77	11	22
	Females .	117	28	13	12	10	4	67	17	33
1900	Males . .	108	28	22	16	8	5	79	13	16
	Females . .	87	11	10	6	7	5	39	22	26
1901	Males . . .	94	25	19	8	7	5	64	16	14
	Females . .	106	18	17	7	4	7	53	12	41

Total for 10 Years, 2579

The total number of deaths reported as due to consumption in the United States during the census year, was 109,750, of which 53,626 were males, and 56,124 were females; and the ratio of deaths from this disease to 1000 deaths from all known causes was 109.9. In 1890 the corresponding ratio was 122.3.

The death rate of the colored from consumption was nearly three times that of the whites, and that of the foreign whites was much higher than that of the native whites. For the last-mentioned class the death rate for those having one or both parents foreign, was also much higher than for those of native parents.

The death rate of males from this disease was considerably higher than those of females.

The total number of deaths reported as due to consumption in the United States in children under 15 years of age, during the census years 1890-1900, was 8051, of which 3554 were males, and 4497 were females.

TABLE No. 68.

Registration States.		Total.	Cities.	Rural.
Connecticut	1900	168.3	182.7	141.8
	1890	233.6	272.6	205.8
District of Columbia	1900	305.3	305.3	. . . . .
	1890	359.0	359.0	. . . . .
Maine	1900	164.9	191.7	159.4
	1890			
Massachusetts	1900	186.2	193.7	162.5
	1890	267.1	279.4	227.0
Michigan	1900	100.7	116.7	94.1
New Hampshire	1900	152.3	176.2	137.3
	1890	193.6	191.9	194.3
New Jersey	1900	180.1	202.2	151.1
	1890	234.5	268.9	189.4
New York	1900	194.1	221.4	137.3
	1890	247.7	306.6	152.3
Rhode Island	1900	195.3	208.3	170.0
	1890	266.6	294.9	227.6
Vermont	1900	152.5	160.9	151.2
	1890	198.8	243.9	194.7
Total	1900	175.9	204.8	134.1
	1890	249.0	293.5	181.0

This table shows that the death rate from consumption in the registration States was higher in the District of Columbia (305.3), which was due mainly to the large colored population. The next highest rate in the registration States was in Rhode Island, where it was 195.3. The death rate from this disease was higher among males than females in the cities, but lower in the rural districts. Excluding the District of Columbia, the highest occurred among males in the city of New York (265.3), and the lowest among males in the rural districts of Michigan.

The following table shows that the death rates due to consumption in white persons under 15 years of age were highest in those whose mothers were born in Italy (50.7), in France (47.1), and in "other foreign" countries (45.9); and were lowest in those whose mothers were born in Poland (11.4), in Bohemia (13.2), and in Germany (26.6).

TABLE NO. 69.

Color and Birthplaces of Mothers.	Under 15 Years.
White	31.8
Colored	246.0
Mothers born in—	
United States	27.5
Ireland	42.2
Germany	26.6
England and Wales	27.2
Canada	34.5
Scandinavia	32.4
Scotland	32.9
Italy	50.7
France	47.1
Hungary	38.6
Bohemia	13.2
Russia	26.7
Poland	11.4
Other foreign	45.9

TABLE NO. 70.—*Percentage of Deaths per 1000 from Consumption in Children from 1 to 15 years of age. (United States).*

Age.	1900		1890	
	Males.	Females.	Males.	Females.
Under 1 year	18.8	17.8	20.1	16.5
1 year	9.3	9.6	9.7	10.9
2 years	5.2	4.8	5.1	5.0
3 years	3.3	4.0	2.7	3.6
4 years	2.3	2.2	2.0	2.8
Under 5 years	38.9	38.4	39.6	38.8
5 to 9 years	8.1	13.2	8.1	11.7
10 to 14 years	9.5	24.7	10.7	27.2

TABLE NO. 71.—*Deaths from Other Tubercular Diseases in Children Under 15 Years.—New York City.*

		0 Year.	1 Yr.	2 Yrs.	3 Yrs.	4 Yrs.	Total Under 5 Years.	5 to 10 Years.	10 to 15 Yrs.	Total Under 15 Years.
	Tabes Mesenterica	17	4			1	22	. . .		22
1890	Tuber. Meningitis	132	79	31	23	13	278	24	8	310
	Other Forms	52	10	6	1	2	71	2	2	75
Males	Spinal	. .	. .	2	1	1	4	4	3	11
	Hip				1		1	1	1	3
	Tabes Mesenterica	9	2	1	. .		12	3		15
	Tuber. Meningitis	92	70	33	19	8	222	20	4	246
Females	Other Forms	37	18	10	3	3	71	4		75
	Spinal			2		3	5	4	1	10
	Hip				2	1	3	3	1	7
	Tabes Mesenterica	16	3	1	1		21	1		22
1891	Tuber. Meningitis	118	88	26	19	12	263	24	8	295
	Other Forms	30	21	4	3	3	61	5	5	71
Males	Spinal			. .	. .	1	1	3	5	9
	Hip	2		. .	. .	2	4	5	3	12
	Tabes Mesenterica	11	4				15	1		16
	Tuber. Meningitis	123	75	29	23	11	261	24	3	288
Females	Other Forms	35	12	5	3	2	57	7	3	67
	Spinal	1					1	4	3	8
	Hip				. .	1	1	10		11
	Tabes Mesenterica	12	4	1	. .		17	1		18
1892	Tuber. Meningitis	148	90	28	14	19	299	23	8	330
	Other Forms	42	25	5	5	3	80	4	1	85
Males	Spinal	. .	1	1	1	1	4	3	4	11
	Hip		. .	1	1	1	3	2	4	9
	Tabes Mesenterica	16	2	2			20	1		21
	Tuber. Meningitis	115	61	37	19	10	242	27	6	275
Females	Other Forms	36	19	5	1	2	63	6	3	72
	Spinal		1		. .	1	2	3	4	9
	Hip	1			. .	. .	1	3	1	5
	Tabes Mesenterica	18	2	1			21	1		22
1893	Tuber. Meningitis	157	80	35	23	14	309	24	7	340
	Other Forms	32	14	9	1	2	58	8	4	70
Males	Spinal		1	3	1	2	7	7	3	17
	Hip		. .	. .		1	1	4	2	7
	Tabes Mesenterica	16	2				18			18
	Tuber. Meningitis	114	59	25	19	16	233	30	4	267
Females	Other Forms	36	16	8	2		62	6	5	73
	Spinal			1	. .		1	5	2	8
	Hip				. .	1	1	1	1	
	Tabes Mesenterica	11	5	3			19			19
1894	Tuber. Meningitis	143	87	27	20	18	295	35	5	335
	Other Forms	25	13	3	5	. .	46	9	4	59
Males	Spinal	1	2	3	1	1	8	4	3	15
	Hip	1		1	. .		2	3	4	9
	Tabes Mesenterica	7	4			1	12	1		13
	Tuber. Meningitis	102	62	37	19	7	227	28	8	263
Females	Other Forms	27	11	4	4	6	52	13	10	75
	Spinal		. .		1	. .	1	2	3	6
	Hip	1				1	2	5	1	8

TABLE NO. 71.—*Deaths from Other Tubercular Diseases in Children Under 15 Years.—New York City.—(Continued).*

		0 Year.	1 Yr.	2 Yrs.	3 Yrs.	4 Yrs.	Total Under 5 Years	5 to 10 Years.	10 to 15 Yrs.	Total Under 15 Years.
	Tabes Mesenterica	12	1	.		.	13	1		14
1895	Tuber. Meningitis	147	73	38	15	17	290	17	9	316
	Other Forms	47	15	8	2	1	73	8	3	84
Males	Spinal		1	2	1	1	5	5	8	18
	Hip	1	.	. .		1	2	3	. .	5
	Tabes Mesenterica	9	1	1	. .	1	12	. .		12
	Tuber. Meningitis	94	61	44	25	12	236	26	7	269
Females	Other Forms	36	15	2	3	3	59	9	1	69
	Spinal		1	3	3		7	5	1	13
	Hip	3	.		1	. .	4	2	4	10
	Tabes Mesenterica	9	1	1		. .	11			11
1896	Tuber. Meningitis	102	75	38	15	22	252	22	8	282
	Other Forms	47	17	6	3	6	79	11	7	97
Males	Spinal	. . .	1	.	2	3	6	5		11
	Hip	.	1	. .	1	1	3	3	2	8
	Tabes Mesenterica	11	4	2		. .	17	1		18
	Tuber. Meningitis	85	59	25	18	15	202	23	4	229
Females	Other Forms	26	14	6	7	4	57	11	11	79
	Spinal	2	. .	1		1	4	3	1	8
	Hip	. . .	. .	. .	. .	.	. . .	3	1	4
	Tabes Mesenterica	10	1	. .	.	.	11	1		12
1897	Tuber. Meningitis	114	73	34	21	11	253	23	4	280
	Other Forms	38	14	10	5	2	69	11	11	91
Males	Spinal	. .	1	. .	1	2	4	5	4	13
	Hip		1	. .		.	1	3	1	5
	Tabes Mesenterica	3	1	.			4			4
	Tuber. Meningitis	102	60	20	15	12	209	24	4	237
Females	Other Forms	38	17	8	4	4	71	12	4	87
	Spinal	2	. .		. .	1	3	2	4	9
	Hip	. . .	. .	1	1	.	2		. .	2
	Tabes Mesenterica	7	.	.	. .	. .	7	. .	1	8
1898	Tuber. Meningitis	113	87	33	24	14	271	26	3	300
	Other Forms	25	23	5	2	3	58	7	4	69
Males	Spinal	. . .	. .	2	1	1	4	2		6
	Hip		. .	. .	. .	. .		2	1	3
	Tabes Mesenterica	10	2	1	.	. .	13			13
	Tuber. Meningitis	91	68	18	19	14	210	23	7	240
Females	Other Forms	32	9	8	2	1	52	5	6	63
	Spinal	1	. .			1	2	2		4
	Hip	. .	. .	1	1	. .	2	.	1	3
	Tabes Mesenterica	7	2	.		. .	9			9
1899	Tuber. Meningitis	107	70	38	19	12	246	18	7	271
	Other Forms	13	11	10	7	3	44	8	3	55
Males	Spinal	.	. .	.	. .	.		2	3	5
	Hip	. .	. .		. .	1	1	1	. .	2
	Tabes Mesenterica	5	1		1	.	7			7
	Tuber. Meningitis	96	69	27	21	16	229	27	5	261
Females	Other Forms	26	15	5	5	3	54	14	12	80
	Spinal	. .	. .	1	. .	1	2	4	1	7
	Hip	1	.	.	. .	.	1	2	1	4

TABLE NO. 71.—*Deaths from Other Tubercular Diseases in Children Under 15 Years.—New York City.—(Continued).*

		0 Year.	1 Yr.	2 Yrs.	3 Yrs.	4 Yrs.	Total Under 5 Years.	5 to 10 Years.	10 to 15 Yrs.	Total Under 15 Years.
	Tabes Mesenterica	7	2	1	. .	. .	10		.	10
1900	Tuber. Meningitis .	97	82	43	21	10	253	27	8	288
	Other Forms . . .	20	8	7	4	4	43	13	9	65
Males	Spinal	2	1		. .	. .	3	. .	4	7
	Hip	. . .	. .	. .	. .	. .	.	5	. .	5
	Tabes Mesenterica	5	3	. .	.	. .	8	. .		8
	Tuber. Meningitis .	96	59	24	22	11	212	30	10	252
Females	Other Forms . . .	18	7	4	1	2	32	4	10	46
	Spinal	. . .	. .	. .	. .	1	1	2	1	4
	Hip	.	1	. .	.	. .	1	2	1	4
	Tuber. Meningitis .	96	59	28	12	13	208	25	6	239
1901	Abdominal Tuber. .	13	5	3	.	1	22	4	3	29
	Pott's Disease . . .	.	1		1	1	3	. . .	. .	3
Males	Cold Abscess . . .	. . .	1	. .	.	. .	1	. . .	.	1
	White Swelling	.	. .	. .	. .	. .	. . .	2	1	3
	Tuber. of Other Org.	4	.	1	1	. .	6	9	6	21
	General Tuber. . .	8	5	5	1	. .	19	7	1	27
	Tuber. Meningitis .	79	48	29	20	8	184	24	10	218
	Abdominal Tuber.	9	.	1	1	. .	11	2	3	16
	Pott's Disease . . .	. .	. .	.	1	1	2	2	. .	4
Females	White Swelling . .	. . .	. .	. .	.	1	1	2	. .	2
	Tuber. of Other Org.	. .	2	. .	1	1	4	4	2	10
	General Tuber. . .	6	2	5	1	1	15	2	4	21

J. Walker Carr reports statistics of necropsies on tuberculous children at the Victoria Hospital. He found 79 in which the disease most probably started in the chest, and 20 in which it seemed to have begun in the abdomen. Here the relation between the two forms of infection is as 1 to 4. In 26 children of early or limited tuberculosis, the thorax alone was affected in 12 cases, the abdomen in 7, being in the proportion of 1 to 1.7. Of 53 tuberculous children under 2 years of age the disease most probably began in the chest in 43 and in only 5 certainly in the abdomen, the proportion in this case being as 1 to 8.6. Out of 27 children over 5 years of age, the disease began in the chest in 12, in the abdomen in 6, the relation being as 1 to 2.

These statistics being all from English sources are fairly comparable, and it appears to me they sustain Thorne's contention that the returns in England of tabes mesenterica represent with fair accuracy the abdominal tuberculosis of children.

Bollinger, in his address at the International Tuberculosis Congress, of Berlin, in 1899, quoted with approval the record of autopsies by Heller (Kiel)of 248 tuberculous children. In 45.5 per cent. of the cases, tuberculosis involved the mesenteric glands. From these it was concluded that milk played a leading rôle in the so-called transmitted tuberculosis of children.

It is plain from what has been said, without quoting further statistics, that in some countries where bovine tuberculosis is very frequent, there is also a great frequency of tuberculosis in children. Bollinger concludes that "although the tuberculosis of cattle and swine does not stand in the first line as source and starting point of human tuberculosis, nevertheless—considering their enormous distribution and progressive additions, and the great danger from the ingestion of the milk of tuberculous cows—they are certainly for humanity the most important and the most dangerous of all animal plagues, and deserve the most earnest attention from the sanitarian and the state."

Symptoms.—The more important symptoms noted in this condition are a general restlessness with a rise of temperature. Children frequently have little or no cough, but some difficulty with respiration for which no distinct physical signs can be found. The temperature will sometimes rise as high as 103° or 104° F., or it may suddenly become apyretic and assume a subnormal tendency. The temperature usually seen is 101° F. The children appear very anæmic and at times cyanotic, mostly on the cheeks and lips. Emaciation usually accompanies this *"intermittent type of fever."* To the inexperienced, the beginning of a miliary tuberculosis resembles mostly the clinical picture which so frequently accompanies intermittent fever. There usually is slight swelling of the peripheral lymph glands. The spleen and liver will be felt enlarged. The urine will give a slight diazo reaction, also an indican reaction. Neither of these, however, are constantly present. We have what is commonly known as a "pre-tubercular anæmia," in which there is a general *tendency to breakdown,* and pallor so well marked, for which there is no distinct group of symptoms. When such profound anæmia exists with slight variations of temperature, then tuberculosis may be inferred; hence this stage is regarded by some clinicians as the "pre-tubercular" stage. Occasionally the examination of the chest shows catarrhal symptoms and rhonchi as accompany an ordinary bronchitis. There is an absence of bronchial breathing and no distinct evidence of dullness on percussion. Frequently these symptoms increase in severity. Cyanosis may accompany this condition and the circulation may be so poor as to show cold feet and hands. Death occasionally follows this condition. The clinical picture here given is the one that is frequently seen in that type of acute miliary tuberculosis running a malignant and very short course. In this condition the children appear very pale and lose weight. There is distinct anorexia which alternates with hyperorexia. Dyspeptic symptoms, such as vomiting and diarrhœa, may alternate with constipation. Such children are usually very sensitive and inclined to be peevish and cry on the slightest provocation.

A study of the above symptoms will show that there are *no distinct typical symptoms* which can be laid *down as positively diagnostic.* It is for this reason that so many other diseases are confounded with miliary tuberculosis until the same has progressed considerably. When there is marked cachexia accompanying nurslings for which there is no distinct reason, and especially so if the fever accompanying the same is an intermittent type, then we should not forget the possibility of our dealing with a case of miliary tuberculosis.

CASE I. A child, 2 years old, was brought to my children's clinic at the New York Post-Graduate Medical School and Hospital, with the following history: She was a bottle-fed infant raised on condensed milk. The bowels were always constipated. Has had one attack of cholera infantum when eleven months old which caused emaciation and general atrophy.

Present illness dates back to three months ago when child had measles followed by a severe broncho-pneumonia. The cough has persisted, but mostly at night. There was no expectoration.

Physical Examination.—Examination reveals an emaciated, very rachitic child, pigeon-breasted, with decided beaded ribs. There is also a kyphosis. The abdomen is distended (pot-belly). The superficial veins are enlarged, the head shows marked frontal, parietal, and occipital rickets. Cranio-tabes is also present, so that we can safely call this a markedly rachitic case. At the left apex there were heard coarse, mucous and sonorous râles, also prolonged expiration. The right lower lobe had several areas of amphoric breathing, also some friction sounds and prolonged harsh expiration. Percussion note was dull. The morning temperature in the rectum was 101° F., pulse 144, respiration 40. The appetite was poor, spleen enlarged, hands and feet cold, and the child perspired freely.

Diagnosis.—Tuberculosis after morbilli.

Family History.—The father died of tuberculosis when the infant was six months old. The mother is still living and in apparent good health. Two other children in the same family show no evidence of illness. The family live in a rear house behind a tenement house. The weight of the child when first seen was sixteen pounds.

Treatment.—An emulsion of the yolks of 6 eggs containing sugar, and 15 drops of creosote carbonate was fed each day. Buttermilk and the serum of bullock's blood was given in wineglassful doses several times a day. *The child was sent to the country* and ordered to live out of doors. The appetite improved and the cough lessened. From month to month the clinical symptoms gradually subsided and at the end of two years the physical signs in the lungs entirely disappeared, and her weight increased to 32 pounds.

In this case tubercle bacilli were found in the sputum that was vomited after a severe coughing paroxysm. The case is well to-day.

CASE II. A girl, 12 years old, seen by me some years ago, was brought to my children's clinic at the New York Post-Graduate Medical School and Hospital. She was suffering with headache, cough, general malaise, poor appetite, and emaciation. She had been under the treatment of a physician who diagnosed malaria. The bowels were irregular, at times constipated, at other times diarrhœal. The urine, light amber color, contained nothing abnormal. The child perspired freely at the slightest exertion, even after each paroxysm of cough.

Previous History.—She was a bottle-fed infant. Had measles and broncho-pneumonia at 3 years. When 5 years old had had whooping-cough which lasted four months. Excepting an occasional cough no other symptoms were present.

Family History.—The family history is good. Both parents are living and four brothers; all are healthy. The only history as to etiology is that this girl has lived in unsanitary surroundings, besides having a weakened state of the respiratory tract.

Physical Examination.—At the first examination she appeared slightly icteric, the spleen was enlarged, the liver normal. There was a slight dullness at the apex of the right side, some mucous râles and harsh breathing. There was a slight expectoration, no history of hæmoptysis. Nose bleeding was complained of occasionally. The diagnosis was made by the presence of tubercle bacilli in the sputum. Each month her sputum was examined, and it was found that the sputum which was expectorated during the early morning hours, between 4 and 6 A.M., contained the greatest number of tubercle bacilli. After four months of treatment it was found that the bacilli in the morning sputum were so sparingly present that evidently some change was going on. The symptoms of headache and malaise disappeared entirely. The icteric condition disappeared. The epistaxis has not shown itself within the last five months. A careful examination of the sputum four times a month has not shown a single tubercle bacillus.

The treatment consisted in removing the child from school and giving her a substantial diet of which proteids formed the chief part. The hygienic conditions were improved as much as the circumstances of the family would permit.

I impressed the family with the necessity of removing the child to the country and she was given into the employ of a farmer, and ordered to be in the open air all of the time. Six months later I saw the case again. She had gained in weight. Her cough had ceased and the physical signs were lessened.

The child lived in the country eighteen months.

At the end of this time there was no evidence of cough nor of the general malaise excepting the physical signs on auscultation and percussion. I have seen this child in all about seven years and believe that she is quite healthy. The pulmonary symptoms have entirely disappeared.

According to Loomis, tuberculosis and cavities in the lungs can and do heal. I have good reason to believe that in this patient, in whom we diagnosed apex tuberculosis or a catarrhal tuberculosis affecting the apices of both lungs, this process was arrested in its incipiency.

Diagnosis.—*Method of Obtaining Sputum:* In infants and young children who do not expectorate, the following method of obtaining sputum is suggested by Findlay, of Glasgow: "With a piece of gauze on the forefinger, the pharynx, and especially the epiglottis, is irritated so as to induce coughing, and any expectoration that is coughed up is swept out of the mouth before it has time to be swallowed. The quantity thus obtained varies, but as a rule is sufficient for bacteriological examination."

The diagnosis will frequently be very difficult, especially so if no data can be obtained which will complete our clinical picture. If the child has been exposed to tuberculous individuals then a suspicion may arise (if there is a tuberculous family disposition) of a possibility of the development of this disease. Frequently the symptoms are such as to resemble typhoid, but if there is an absence of roseola, if the diazo reaction is absent, and if the Widal reaction is absent, then miliary tuberculosis must be inferred. The ophthalmoscopic examination must not be looked upon as a positive criterion, for miliary tuberculosis may exist in spite of the absence of tuberculosis of the choroid. For differential diagnosis between tuberculosis and syphilis, see chapter on "Syphilis," page 723.

Tuberculin.—The use of injections of tuberculin for diagnostic as well as therapeutic results dates back to 1891, when Koch first announced clinical results. My experience with tuberculin at that time, through the courtesy of George F. Shrady, at the St. Francis Hospital, New York, was not very encouraging. I have also seen cases in which tuberculin was used through the courtesy of Prof. Adolph Baginsky, at the Berlin Children's Hospital. Baginsky has never encouraged the use of these injections. In his sixth edition of "Lehrbuch der Kinderkrankheiten," 1899, page 350, he says: "I do not believe that the injection of tuberculin, especially in very small children, is without danger. I am aware that Kossel, in Berlin, uses the injections very extensively and without ill results." He states the minimum dose for an infant is from 1 to 5 milligrams.

TUBERCULIN REACTION AN AID TO THE DIAGNOSIS OF LATENT FORMS OF TUBERCULOSIS.[1]

Von Pirquet found that by inoculating the skin with a minute quantity of old tuberculin a local inflammatory reaction is produced. There is no fever nor general systemic disturbance after such inoculation. With the older method of Koch fever followed each injection. The technique is as follows: Wash the arm with ether and scarify three small areas, but not enough to produce a bloody surface. Into two of these scarified areas inoculate (similar to vaccination) diluted tuberculin of the strength of one part tuberculin with three parts normal saline solution. Leave the third scarified area without inoculation as a control. After twenty-four, rarely later than forty-eight hours, a local inflammatory reaction, about 10 millimeters in width, surrounding the inoculated area, denotes a positive reaction. In the last stages of miliary tuberculosis and tuberculous meningitis no reaction follows. The ophthalmo reaction[2] is another method of diagnosis.

Prognosis.—The success attained during the last few years[3] in the treatment of tuberculosis proves the scientific progress made. Several years ago this disease was erroneously considered hopeless.

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[1] Complete literature and details published in the New York Medical Journal, October 19, 1907.

[2] Calmette advises using a $^1/_{100}$ per cent. dilution of tuberculin dropped into the eye.

[3] "Tuberculosis and How to Combat It," prize essay by S. A. Knopf, is well worth reading.

Modern physicians recognize the importance of treating the collapsed lung that has become so through unsanitary surroundings, in the light of cause and effect. The prognosis therefore will depend on the age of the patient, the stage of the disease in which treatment is commenced, and the will power of the patient. The vitality of children and their ability to pass through long periods of illness and finally recover should be remembered when the outcome of the case is considered. Severe forms of marasmus, with marked emaciation, apparently hopeless, finally recovered. I have also seen severe forms of apex tuberculosis in children that entirely recovered after proper hygienic and dietetic treatment was instituted.

It is our duty to instruct parents and those in charge of children of the dangers on the one hand where treatment is neglected, and to picture to them on the other hand how successful other cases have been when the disease was properly handled.

Treatment.—*Dietetic Treatment:* Next to sunshine, fresh air, and pulmonary gymnastics comes nutrition. A child that is properly strengthened with milk, buttermilk, cocoa, eggs, cereals, cheese, green vegetables, fruits, meats, and meat broths will certainly be better able to recover than one that is underfed.

One Point Concerning Feeding.—Milk if given should not be repeated oftener than once in four hours. The yolk of a fresh egg may be added just before feeding. When soup is given the yolk of a fresh egg may be added to it. I frequently give the yolks of eight or ten eggs in twenty-four hours if the gastric condition warrants the same.

Strict attention must be paid to the bowels so that we do not overfeed and produce a dyspepsia by overfeeding. If milk is not well borne it may be peptonized.

General Treatment.—In the treatment of tuberculosis the most important point to remember is that fresh air is the best lung disinfectant that we possess. No remedy will kill tubercle bacilli as quickly as sunshine and fresh air. This should be impressed on every family wherein a case of tuberculosis is found. The progress made in recent years by climatic treatment has demonstrated the fact that cavities in the lung will frequently heal under proper treatment. The open-air treatment has gained such a strong foothold that we do not encounter the same difficulties that we did years ago when recommending open windows night and day. The great bugbear of night air should be removed, because fresh air at night is equally as important as it is by day.

Hygienic Treatment.—The value of sunshine, fresh air, and outdoor life, best known as the hygienic treatment of tuberculosis, must not be forgotten. To cure any case of tuberculosis by an indoor life is out of the question. When exercise can be taken it should be insisted upon, as thereby we stimulate metabolism and increase the power of assimilating food.

Pulmonary Gymnastics.—Deep inspiration and expiration will oxygenate the lungs when regularly performed.

Deep breaths taken in the mountains on which there are pine-needle trees will do more toward expanding and impregnating diseased or collapsed portions of the lung than will the inhalation of a hundred times that quantity of pine-needle oil in the close stuffy room when diffused from an atomizer. The hygienic treatment must not be confined to walking and breathing the pure air, but must be aided by tepid bathing and by stimulating the circulation of the blood by friction with a coarse Turkish towel. Sea salt can be added to the bath. When the feet or hands are cold they should be briskly rubbed until the blood circulates freely.

Medicinal Treatment.—Codliver-oil internally should be tried. If it is not well borne it can be used by external friction over the whole body, daily for ten or fifteen minutes. This is the so-called codliver-oil bath. If codliver-oil is not tolerated, butter should be given in large quantities. Codeine in $^1/_{10}$ to $^1/_4$-grain doses can be given, or heroin in $^1/_{50}$ to $^1/_{25}$-grain doses, three times a day, may be given to relieve cough. For the relief of the night sweats sulphate of atropine, $^1/_{150}$ to $^1/_{100}$ of a grain, three times a day, should be given. Toxic symptoms should always be looked for in the pupils when administering these drugs. A laxative dose of citrate of magnesia or calcined magnesia, 5 to 10 grains, several times a day, is useful. Creosote carbonate, 5 to 20 drops, three times a day, given in the form of an emulsion, has served me very well.

℞ Creosote carbonate	1 drachm
Mucilage acacia	1 ounce
Emulsion amygd. dulc.	q. s. ad 2 ounces

Sig.: One drachm three or four times a day.

If blood is expectorated, then 5 to 15 drops of fluid extract of ergot can be given every few hours. In other cases 5 to 10 grains of powdered alum, repeated every few hours, may do good. I have also seen good results from 5 and 10-grain doses of gallic acid. Fluid extract of hydrastis canadensis, 3 to 10 drops, several times a day, or hydrastinine hydrochlorate, $^1/_{100}$ grain, three times a day, may be tried.

Tincture of iron in 5 to 10-drop doses, is a good hemostatic; besides it is a valuable tonic.

Stimulation is sometimes required. Old rye whisky, wine or champagne is indicated. It not only stimulates but promotes the appetite in debilitated cases.

CHRONIC PULMONARY TUBERCULOSIS.

This condition is rarely found in infants and very young children. When chronic pulmonary tuberculosis is noted it is usually seen in children after the sixth or eighth year.

Pathology.—Osler states that small cavities are by no means rare in chronic pulmonary tuberculosis of children, but very large excavations are rare; thus in 265 cases noted by Barthez and Sanné there were 77 cases with excavation, chiefly in the upper lobes. In the analysis by Leroux of the cases of the late Parrot, in 219 children under 2 years of age, there were 57 instances in which cavities existed. In five of these the children were under three months. In long-standing cases hard, firm, fibrous tubercles are found, and sometimes cutaneous nodules. The primary lesion in a great majority of instances is a tuberculous bronchopneumonia, taking its origin in the smaller bronchioles, leading to peribronchial nodules and subsequent peribronchial alveolitis. The lesions are

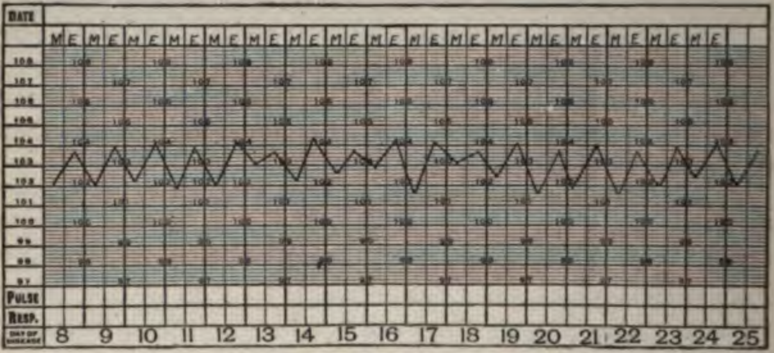


Fig. 161.—Fever curve during the early period of Chronic Pulmonary Tuberculosis. The daily excursions are slight, and generally range between 102° and 104° F. (Original.)

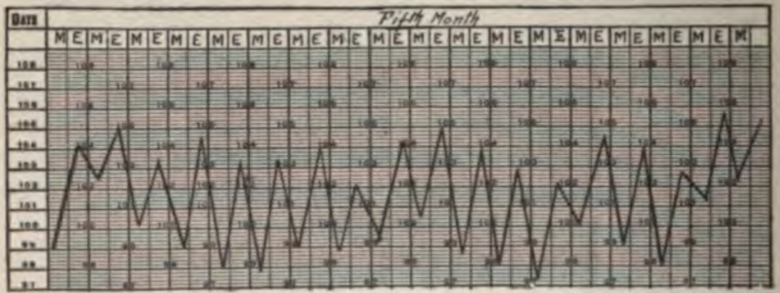


Fig. 162.—Temperature curve during the fifth month, when the disease is more extended and softening has taken place with the formation of cavities. The temperature is more hectic in character. The morning temperature may be normal or subnormal, while the evening temperature ranges between 103° and 105° F. (Original.)

similar to those met with in the tuberculosis of adults—miliary tubercles, peribronchial nodules, caseous blocks, areas of softening and of fibroid induration, and cavities of various sizes. We do not see so frequently the invasion of the lung from the apex downward. The chief seat of disease may be in the central portion of the lung, or even at the base. In tuberculosis of the lymph glands, the groups along the trachea and about the bronchi may be greatly enlarged and caseous, forming on section a very striking feature in the chronic pulmonary tuberculosis of children.

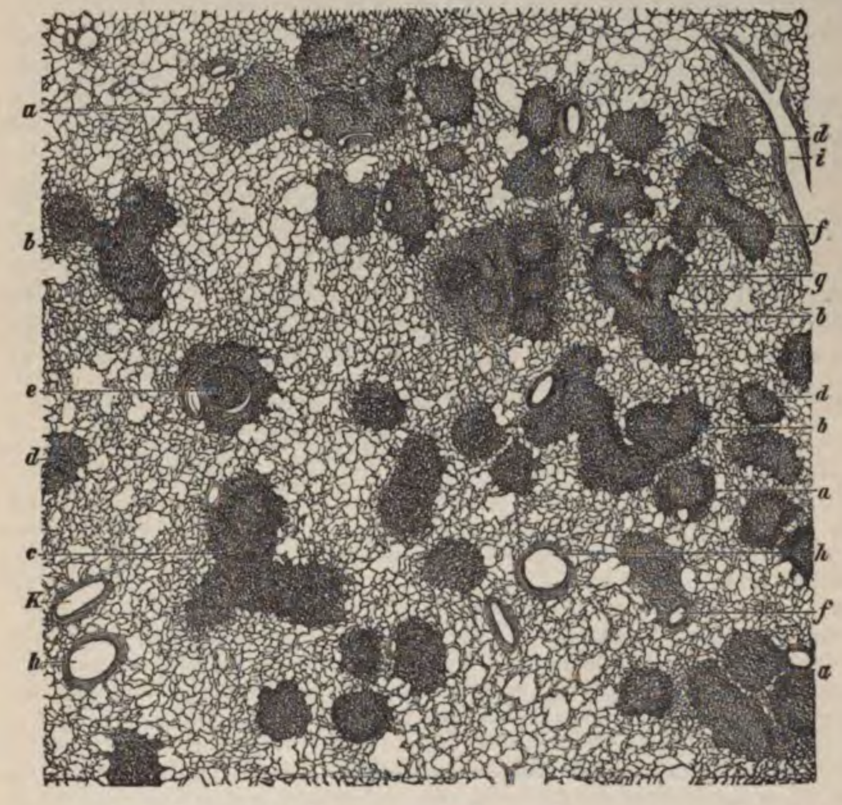


Fig. 163.—Chronic Nodular Tuberculous Broncho-pneumonia. *(a, b, c, d)* tuberculous foci of variable size and shape, corresponding to the infiltrated alveolar system; *(e)* transverse section through an infiltrated occluded bronchiole; *(f)* small arterial branch; *(g)* group of nodules undergoing coalescence; *(h)* small unaltered bronchus; *(k)* artery. X6. (Ziegler.)

Symptoms.—Chronic pulmonary tuberculosis in the child presents the same symptoms as in the adult. Usually a broncho-pneumonia will first be encountered, or the symptoms present will resemble those of a broncho-pneumonia. When fever persists and there are evidences of a general breakdown, such as malaise, loss of appetite, and emaciation with or without cough, then this condition must be suspected. When these children expectorate, the same resembles that seen in adults. Tubercle bacilli have frequently been found in the expectoration of cases under my care. Blood spitting in which the mucus is blood-stained has been seen by me. The blood is bright red in color. Epistaxis is sometimes seen during the course of the disease. The temperature ranges between 100° and 102° F. in the beginning of the disease; later on it assumes the real hectic character; thus, the temperature may be 99° to 100° F. in the morning, and 103° to 105° F. in the evening.

Pleuritic pains are complained of in various parts of the chest. There is marked dyspnœa and frequently cyanosis. Osler states that some cases do not have any pain throughout the course of the disease. A general emaciation associated with muscular weakness and anæmia is usually seen later in the disease. Tubercular ulceration of the intestine will frequently cause diarrhœa. In a child seen by me with chronic tuberculosis of the lungs, a general anasarca was present.

Katie B., 8 years old, has been a very delicate child. She was breast and bottle-fed, and lived in a tenement house.

Family History.—The father was a drunkard and did not support his family; the mother is a frail anæmic woman, although no evidence of pulmonary disease could be found. The child was late in walking, late in teething, and late in talking. Distinct evidence of rickets of the bones was everywhere noted. When 4 years old the child had measles, complicated with broncho-pneumonia, after which a cough remained. Three months after the measles the child still coughed and showed evidences of malnutrition. The cough persisted in spite of codliver-oil, malt extract, and iron, which was liberally given. As the family were poor they could not take the child to the country for a complete change of air. I did not see the case again for two years, when I saw it through the courtesy of Dr. John H. Wurthman. At this time she had a cavity at the apex of the right lung, was terribly emaciated, and complained of pain on breathing and suffered with marked dyspnœa. Pleuritic friction sounds were heard over small areas of the chest on both sides. The child had hæmoptysis besides a purulent expectoration. Tubercle bacilli were found in the sputum. She died after a violent hæmorrhage, from exhaustion and heart failure.

The treatment is the same as described in the article on "Acute Tuberculosis."

CHAPTER VI.

ACUTE DIPHTHERIA.

Diphtheria is an acute infectious disease caused by the invasion of a specific micro-organism known as the Klebs-Loeffler bacillus.

It is a disease characterized by the presence, locally, of false membranes, known as pseudo-membranes.

Etiology.—This disease is most frequently met with in children, although adults are not exempt from it. It is met with in the newly born (Jacobi). It is most frequently seen about the second year. Children are especially disposed to this disease between the ages of 1 and 5 years. Baginsky reports a series of 2711 cases in which:—

84 occurred during the first year.
889 between the first and fourth year.
1411 between the fourth and tenth year.
318 between the tenth and fourteenth year.

There is no difference in the sex regarding the predisposition to diphtheria:—

1311 in the above series were boys.
1400 were girls.

Infection is spread primarily by contact. It can be transmitted through dishes, play toys, and furniture to which the Klebs-Loeffler bacilli adhere. Infections have been traced to water and milk which contained the diphtheria bacillus. We know that the Klebs-Loeffler bacilli adhere to the walls and ceilings of rooms. The etiology of diphtheria remained obscure until Loeffler discovered the bacillus in 1884.

Sewer gas is not looked upon as a cause of diphtheria *per se*. When the system is poisoned by sewer gas it will offer less resistance to the infection of the Klebs-Loeffler bacillus than otherwise.

Unhealthy Throats.—The presence of diseased tonsils, or adenoid vegetations in the pharynx, are usually foci for the development and propagation of the Klebs-Loeffler bacillus. The writer has frequently questioned the patients at the Willard Parker Hospital regarding former throat diseases. It was rare to find a throat infected with diphtheria that did not have previous tonsillar or other throat disease.

Thus it would appear wise to put the throat in as healthy a state as possible in order to prevent the opportunity for receiving an infection of diphtheria.

False diphtheria, in which there is a non-virulent germ present, frequently resembles diphtheria.

Hunt's differential stain and also the Neisser stain will differentiate the non-virulent from the virulent form of germ.

Table No. 72.—*Deaths from Diphtheria and Croup, in Children under 15 Years—(Old) City of New York.*

			0 Year.	1 Year.	2 Years.	3 Years.	4 Years.	Under 5 Yrs.	5-10 Years.	10-15 Years.
1890	Males	913	99	233	193	145	92	762	143	8
	Females	843	71	188	180	162	90	691	139	13
1891	Males	1000	111	232	210	173	111	837	155	8
	Females	934	85	202	203	167	95	752	172	10
1892	Males	1101	92	269	270	187	123	941	148	12
	Females	968	67	222	205	181	108	783	173	12
1893	Males	1241	98	300	278	218	121	1015	211	15
	Females	1278	110	273	276	199	137	995	261	22
1894	Males	1456	125	351	311	253	167	1207	233	16
	Females	1386	109	301	306	228	167	1111	255	20
1895	Males	1000	130	247	200	175	102	854	138	8
	Females	946	84	232	217	138	94	765	169	12
1896	Males	872	96	241	193	112	100	742	119	11
	Females	859	65	197	188	141	101	692	151	16
1897	Males	756	82	196	169	106	75	628	118	10
	Females	811	74	213	156	122	76	641	164	6
1898	Males	456	52	149	91	57	42	391	59	6
	Females	442	35	101	94	61	48	339	92	11
1899	Males	518	62	133	107	88	45	435	76	7
	Females	544	52	149	112	86	59	458	78	8
1900	Males	647	72	147	116	119	62	516	114	17
	Females	589	64	108	115	89	75	451	126	12
1901	Males	606	64	172	122	102	51	511	89	6
	Females	598	77	123	129	90	64	483	99	16

TABLE No. 73.—*Per Cent. of Mortality from Diphtheria in Different Cities of the United States.*

Cities.	Treatment.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.
Baltimore, Md.	No antitoxin .	. . .	. . .	. . .	19.83	17.52	15.01	14.62	13.37
Baltimore, Md.	With antitoxin	. . .	. . .	. . .	9.8	9.8	9.8	8.3	6.87
Lowell, Mass.	No antitoxin .	48.0	56.0	27.0	35.0	39.0	30.0	30.0	26.0
Lowell, Mass.	With antitoxin	28.0	10.0	9.0	9.0	12.0	4.0	11.0	8.0
Newark, N. J.	No antitoxin .	23.0	31.0	19.0	17.5	14.5	14.6	22.7	19.0
Newark, N. J.	With antitoxin	13.0	11.0	11.0	10.5	8.77	8.1	6.6	7 0
Rochester, N.Y.	No antitoxin .	. .	22.7	21.7	23.9	17.5	18.7	8.9	10.96
Rochester, N.Y.	With antitoxin	. . .	12.24	9.6	9.0	9.7	6.5	8.4	6.97

Bacteriology.—In the year 1883 bacilli, which were very peculiar and striking in appearance, were shown by Klebs to be of constant occurrence in the pseudo-membranes from the throats of those dying of true epidemic diphtheria. One year later Loeffler published the results of a very thorough and extensive series of investigations on this subject. He found the bacillus described by Klebs in most but not all cases of throat inflammations which had been diagnosticated as diphtheria. He separated these bacilli from the other bacteria present and obtained them in pure culture. When he inoculated these bacilli upon the abraded mucous membrane of susceptible animals, pseudo-membranes were produced, and frequently death followed. If a certain amount of a bouillon culture was injected subcutaneously into guinea pigs, death was caused with characteristic lesions. Loeffler's failure to find the bacilli in every case examined is now explained by the fact that certain varieties of pseudo-membranous inflammation not due to the diphtheria bacillus, such as occur especially in scarlet fever, were then wrongly considered to be true diphtheria.

"In 1887 further studies by Loeffler added to the proof of the dependence on the diphtheria bacilli. In 1888 D'Espiné found the bacilli in 14 cases of characteristic diphtheria, and proves them to be absent in 24 cases of mild sore throats, which, clinically, were believed not to be cases of diphtheria. In the same year the first portion of the results of the very important investigations of Roux and Yersin was published, and the dependence of diphtheria bacilli may be considered to have been established. Roux and Yersin found the diphtheria bacilli were present in all characteristic cases of diphtheria, and that these bacilli possessed the cultural and pathogenic qualities of those described by Loeffler. They found, too, when the bacilli were inoculated upon the healthy mucous membrane of the trachea of the rabbit, no result followed; but, if the inoculation was made on the abraded membrane, phenomena occurred, which strikingly resembled those present in membranous laryngitis in man, *i.e.*, congestion of the mucous membrane, followed by the formation of the pseudo-membrane, œdematous swelling of the tissues and of the glands of the neck, dyspnœa, stridulous breathing and asphyxia. Injections of cultures beneath the skin of rabbits and guinea-pigs in sufficient quantity caused their death in from thirty-six hours to five days, the period varying in ratio to the susceptibility of the animal, and the number and violence of the bacteria introduced. The same result followed the injections of filtered cultures, showing the products formed by the growth of the bacilli were, by themselves, capable of causing the general lesions.

"Roux and Yersin were also able to produce in animals characteristic diphtheria paralysis. They produced this in many cases where the inoculated animal did not succumb to a too rapid intoxication. Paralysis commenced in a pigeon three weeks after the inoculation of the pharynx after all membrane had disappeared, and the animal seemed to have completely recovered.

"In rabbits the paralysis usually commenced in the posterior extremities and then gradually extended to the whole body, causing death by paralysis of the heart or respiration. In rare instances, the muscles of the neck or larynx were first paralyzed, and thus characteristic symptoms were caused.

"The authors conclude: 'The occurrence of these paralyses, following the introduction of the bacilli of Klebs and Loeffler, completes the resemblance of the experimental disease to the natural malady, and establishes with certainty the specific rule of this bacillus.'

"Finally, the microscopic changes in the internal organs of animals dying of experimental diphtheria produced by the bacilli have been shown by Welch and Flexner, and by Babes and others, to be essentially the same as those produced by diphtheria in man, and thus a still further proof is afforded of the specific rule of this bacillus."

The reason for the various observations detailed above have since been confirmed by a great number of combined clinical and bacteriological investigations, so that all who have studied the bacteriology of diphtheria would now agree with the following statement made by Welch in an address on diphtheria: "All the conditions have been fulfilled for diphtheria which are necessary to the most rigid proof of the dependence of an infectious disease upon a given micro-organism, viz.: the constant presence of this organism in the lesions of the disease, the isolation of the organism in pure culture, the reproduction of the disease by inoculation of pure cultures, and similar distribution of the organism in the experimental and *the natural* disease. In view of these facts we must agree with **Prudden** that we are now justified in saying that the name diphtheria, or at least primary diphtheria, should be applied, and exclusively applied, to that acute infectious disease usually associated with pseudo-membranous affections of the mucous membrane which is primarily caused by the bacillus diphtheriæ of Loeffler."

The germs cannot be found in the blood, but usually in the membranes. Now and then the specific germ may not be easily found in the pseudo-membranes. When such is the case, several cultures may be necessary to demonstrate the presence of the Klebs-Loeffler bacillus. This bacillus is most easily found in the older pseudo-membranes.

Frequently we find the streptococcus or the staphylococcus accompanying the Klebs-Loeffler bacillus. We are not justified in pronouncing the visible pseudo-membrane diphtheria unless we find the Klebs-Loeffler bacillus present.

When there is a pseudo-membrane present and the Klebs-Loeffler bacillus cannot be found, then a provisional diagnosis of diphtheria can be made.

Technical errors will sometimes occur in the taking of cultures or in inoculating culture media. Thus the germ may not be found. The rule always followed by the writer is to *isolate every patient* having visible membranes until the same have disappeared.

The bacillus can frequently be transmitted through animals. Cows, cats, dogs, and pigeons having diphtheria can easily infect those coming in contact with them. Cows' milk can transmit the disease if the Klebs-Loeffler bacillus exist therein.

Characteristics of the Loeffler Bacillus.—The diameter of the bacilli varies from 0.3 to 0.8 micro-millimeters, and the length from 1.5 to 6.5 micro-millimeters. They occur singly and in pairs, and very infrequently in chains of three or four. The rods are straight or slightly curved, and usually are not uniformly cylindrical throughout their entire length, but are swollen at the ends, or pointed at the ends and swollen in the middle portion. Even from the same culture different bacilli vary greatly in their shape and size. The two bacilli of a pair may lie with their long diameter in the same axis, or at an obtuse or an acute angle. The bacilli possess no spores, but have in them highly refractile bodies. They stain readily with the ordinary aniline dyes and retain their color after staining by Gram's method. With an alkaline solution of methylene blue, the bacilli, from blood serum especially, and from other media less constantly, stain in an irregular and extremely characteristic way, namely, club-shaped.

The bacilli do not stain uniformly. Certain oval bodies situated in the ends, or in the central portions, stain much more intensely than the rest of the bacillus. Sometimes these highly stained bodies are thicker than the rest of the bacillus, again they are thinner and surrounded by a more slightly stained portion. The bacilli seem to stain in this peculiar way at a certain period in their growth, so that only a portion of the organisms taken from a culture at any one time will show the characteristic staining. In old cultures, it is often difficult to stain the bacilli, and the staining, when it does occur, is frequently not at all characteristic.

Growth on Blood Serum.—If we examine the growth of the diphtheria bacillus in pure culture on blood serum, we will find at the end of ten to twelve hours little colonies of bacilli, which appear as pearl-gray or whitish-gray slightly raised points. The colonies when separated from each other may increase in forty-eight hours, so that the diameter may be $^1/_4$ inch. The borders are usually somewhat uneven. These colonies lying together fuse into one mass, especially if the serum is rather moist. During the first twelve hours, the colonies of the diphtheria bacilli are about equal in size with those of the streptococci; but after this time the diphtheria colonies become larger than those of the streptococci, nearly equaling those of the staphylococci. The diphtheria bacilli in their growth never liquefy the blood serum.

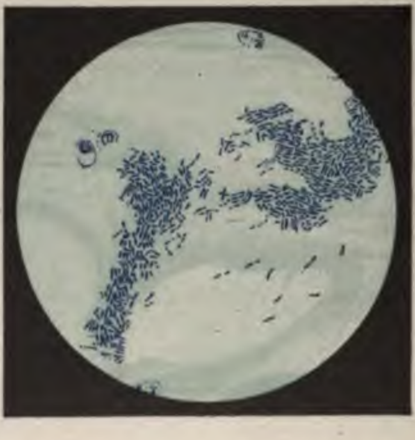
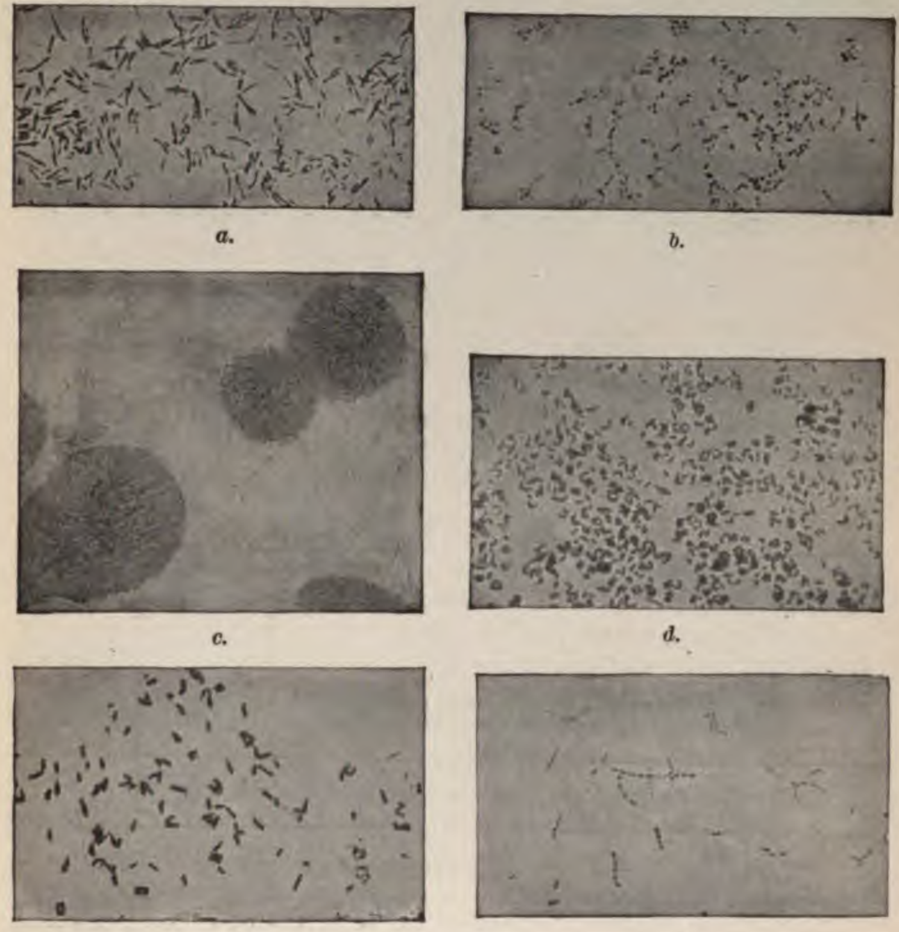


Fig. 164.—Diphtheria or Klebs-Loeffler bacilli; smear preparation from tonsillar deposit. Loeffler's stain. X800. (Lenhartz-Brooks.)

The Relation Between the Length of the Bacillus and its Virulence.—Some investigators believed that the degree of virulence possessed by the diphtheria bacilli could, to a certain extent, be judged by their length. The longest bacilli were supposed to be the most virulent; those of medium length less so, and the shortest, little if at all virulent. By observing this characteristic it was thought cultures might become helpful in prognosis.

"The short Klebs-Loeffler bacillus apparently produces a toxin of greater virulency than the larger forms, although the local manifestations may not be so extensive.[1]



a. b. c. d. e. f.

Fig. 165.—True and False Diphtheria. *(a)* Diphtheria bacilli x100 diameter; *(b)* characteristic diphtheria bacilli x1000. *(c)* colonies of diphtheria bacilli x124 diameters; *(d)* even-stained short diphtheria bacilli x1000; *(e)* pseudo-diphtheria bacilli X1000; *(f)* streptococci smeared directly upon cover glass from throat exudate X1000. (After Park.)

"The long Klebs-Loeffler bacillus and the streptococci, when found alone, give rise to a mild type of the disease.

"The streptococcus is found associated with Klebs-Lœffler bacillus in most severe cases. Its special significance is not so clear, but it is possible that by causing a more intense inflammatory reaction it opens avenues by which the toxins of the Klebs-Loeffler bacillus, plus its own toxin, may find more ready entrance into the circulation.

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[1] N. J. Class (N. Y. Medical Journal, May 14, 1897).

"The apparent beneficial action of the antitoxin of the Klebs-Loeffler bacillus in cases where this bacillus is not present may be due to the fact that though the local action of the different microbes varies to a considerable extent, the action of their toxins, as is shown by the similarity of the constitutional symptoms produced by them, presents many kindred features. The thought therefore arises that the antitoxin of one infection may have an inhibitory effect on the toxin of another as is shown by the fact that whooping-cough and some other infectious diseases have been shown to occur less frequently in vaccinated persons, and some cases have apparently been cured by vaccination.

"By the term Klebs-Loeffler bacillus is meant the medium-sized bacillus as described by Martin."

Very careful notes have been made on this point in the examination of the bacteria from the original serum tubes in 1613 cases.

The results of the examinations are shown in the following table:—

TABLE No. 74.

	No. of Cases.	Mortality.
Bacilli of average size found in	1398	26 per cent.
Bacilli longer than average in	82	27 per cent.
Bacilli shorter than average in	67	35 per cent.
Bacilli short, not characteristic in shape and evenly stained, of which many were pseudo-diphtheria bacilli	66	12 per cent.
Number of cases examined	1613	

"The results obtained from this examination of 1613 cultures, therefore, indicate that in New York the great majority of cases of diphtheria yield in cultures, bacilli of medium size, which are characteristic in shape and manner of staining. In a moderate number of cases the bacilli found are much longer, and in about an equal number they are much shorter. Both the clinical histories and the animal experiments show that whenever in their shape and in the way in which they take the staining fluid the bacilli are characteristic, no information as to their virulence, either in men or animals, can be gathered from their length. Those bacilli, on the other hand, which are short and stain uniformly with methylene blue, usually prove to be of the pseudo-diphtheria type, and have no virulence in animals."

Pathology.—The pathological lesions are caused by the specific action *of the* Klebs-Loeffler bacillus and the associated pathogenic bacteria. In

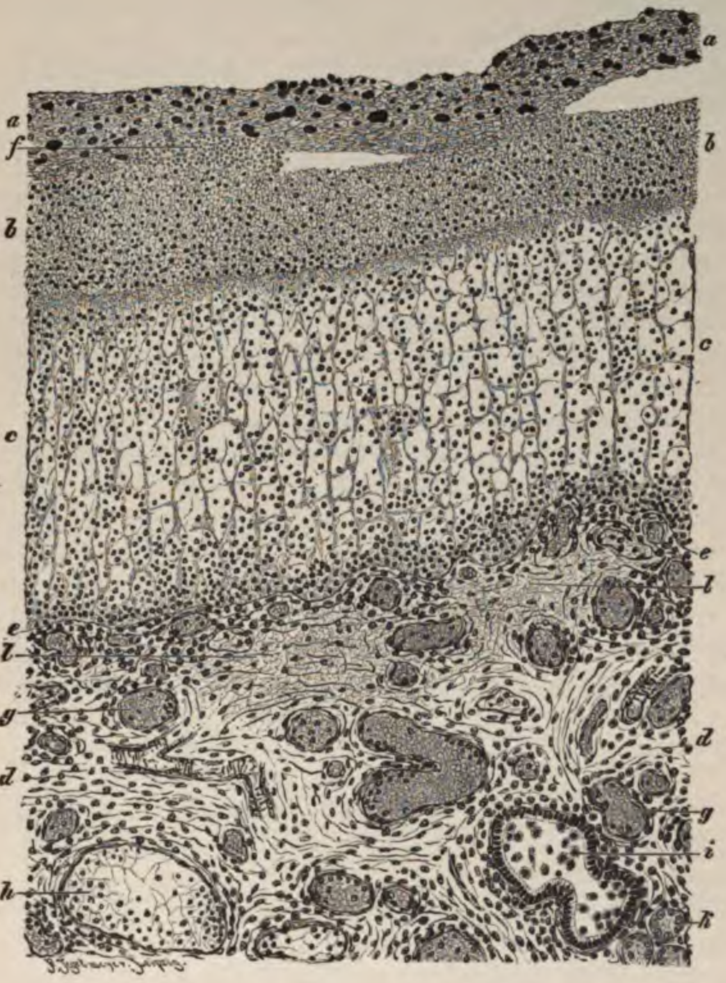

Fig. 166.—Section from an inflamed uvula covered with a stratified fibrinous membrane, from a case of diphtheritic croup of the pharyngeal organs (Müller's fluid, hæmatoxylin, eosin). *(a)* Surface layer of coagulum, consisting of epithelial plates and fibrin and containing numerous colonies of cocci; *(b)* second layer of coagulum, consisting of fine-meshed fibrin network enclosing leucocytes; *(c)* third layer of coagulum, lying upon the connective tissue, and consisting of a wide meshed reticulum of fibrin enclosing leucocytes; *(d)* connective tissue infiltrated with cells; *(e)* infiltrated boundary layer of the connective tissue of the mucous membrane; *(f)* heaps of red blood-cells; *(g)* widely dilated blood-vessels; *(h)* dilated lymph-vessels filled with fluid, fibrin, and leucocytes; *(i)* duct of a mucous gland distended with secretion; *(k)* transverse section of a gland; *(l)* fibrin reticulum in the superficial layer of connective tissue. X45. (Ziegler.)

addition thereto the toxins generated by the various micro-organisms produce local destructive changes.

As a rule, the local pathological lesion is a whitish, yellowish-white, or grayish-white membrane, which is firmly adherent. In some instances a distinct greenish or black color (gangrenous type) is evident.

In a study of the pathology of 220 fatal cases of diphtheria by Mallory, Councilman, and Pearce they found two varieties of membrane; first, a dense, firm, elastic membrane composed of a reticular structure with considerable uniformity in the size of the beams composing it. This membrane can be stripped off in large flakes. Second, a more friable variety composed of fibrin forming a reticulum with more irregular spaces and fibers. The fibrin spaces contain leucocytes, amongst which are found some broken down cells (detritus). The epithelium below the membrane contains polynuclear leucocytes and lymphocytes.

The interval lesions of diphtheria are those resulting from degenerative changes affecting organic structures. As a rule, hæmorrhages are found in addition to marked degeneration. The lymph nodes are usually swollen and contain small foci of cell-necrosis. Broncho-pneumonia, if present, shows the usual lesions common to this condition. The nervous system, heart, spleen, lungs, and liver show the most destructive effect of the toxins of diphtheria.

TABLE No. 75.—*Two hundred and nine cases of Diphtheria studied by Councilman, Mallory, and Pearce, of Boston, in 1901, showing the percentage of cases in which the different bacteria were found by culture.*

	Heart's Blood.	Liver.	Spleen.	Kidneys.
Diphtheria Bacillus	6 per cent	20 per cent.	12 per cent.	19 per cent.
Streptococcus	20 “	30 “	27 “	28 “
Staphylococcus Aureus	2.5 “	4 “	3 “	8 “
Pneumococcus	1.5 “	2.5 “	1.5 “	5 “

The Blood.—John S. Billings, Jr.,[1] says:—

1. The red corpuscles of the blood in diphtheria undergo a diminution in number in cases of moderate severity and in severe cases. Regeneration is slow.

2. The leucocytes are increased in numbers in all but two classes of cases, exceptionally mild cases and exceptionally severe ones. As a rule, the amount of leucocytosis is directly proportionate to the degree of severity of the case. The leucocyte-curve shows no correspondence to the clinical course of the disease. The number of leucocytes often remains higher than normal for days after all inflammation has disappeared. The leucocytosis is similar in character to that seen in pneumonia and scarlet fever, the increase of the leucocytes being in the so-called polynuclear forms.

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[1] *Annual* Report, Health Department, 1897.

3. The percentage of hæmoglobin falls coincidently with the number of the red blood-corpuscles, and to the same relative degree. But the regeneration of the hæmoglobin takes place much more slowly than that of the red blood-corpuscles.

4. In cases treated with antitoxin the diminution in the number of the red corpuscles is much less marked than in those cases treated without it; in a majority of cases no such diminution takes place. The leucocytes are apparently unaffected by the antitoxin. The hæmoglobin is also much less affected in the cases treated with antitoxin, thus confirming the statement as to the red corpuscles.

5. In healthy individuals injected with antitoxin, the red corpuscles show a very moderate reduction in number in about one-half the cases. The hæmoglobin is correspondingly affected. The leucocytes are apparently unaffected by the injections.

6. No peculiar characteristic changes in the morphology of the corpuscles were to be made out.

7. It is improbable that any information of prognostic importance is to be gained by the examination of blood in diphtheria.

8. The antitoxin treatment of diphtheria has no deleterious effects upon the blood-corpuscles. On the contrary, it seems to prevent degenerative changes which would otherwise be brought about.

The Effect of Diphtheria Toxin on the Nervous System.—E. Luisada and D. Pacchioni[1] report the results of a number of experiments with diphtheria toxin on dogs:—

1. The diphtheria toxins applied directly to the nervous system provoke a profound lesion at the point of application, characterized by an inflammatory and degenerative action.

2. These lesions are propagated more or less extensively from the point of application.

3. In non-immunized dogs, which had been injected with a dose sufficiently toxic, the phenomena of local reaction were noted.

4. In immunized dogs the toxins constantly produced alterations in the central nervous system, intense, localized, but of less extent than those produced in dogs non-immunized.

5. The toxin applied directly to the medulla is propagated rapidly in all directions, preferring the posterior columns, the gray matter, and the central canal, as routes. In consequence of the bulbar invasion death occurred in the animals more rapidly when the toxins were introduced into the medulla than when applied to any other portion of the cerebro-spinal axis. When the toxins were introduced into the cerebral cortex, characteristic lesions of these regions were manifested. Death occurred later through propagation of the poison to the medulla.

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[1] Giornale della R. Accademia di Medicina di Torino, vol. lxi.

6. Toxins introduced into the sheath of the sciatic nerve provoked an inflammatory process more or less intense, but more circumscribed than in the central nervous system. From the nerves the poison ascended to the medulla, chiefly through the posterior columns, and thus provoked an ascending myelitis.

7. The lesions produced upon the neuroglia by direct action of the toxins are similar to those reported by Vassale, Donaggio, and others in the various intoxications and infective processes. In the oblongata the prevalent alterations are found in the crossed pyramidal tracts and posterior columns.

8. The alterations produced by the toxins affect the nerve fibers more than any other part of the nervous tissue. These lesions affect principally the myelin, and consist of a physical modification of it, whereby the connections between the various nerves are lost. There is partially a chemical modification of the myelin also present.

9. The local action of the toxins has much importance in the genesis of various paralyses as seen in the human family, attacking first the sheaths of the nerves, then the nerves, and later the nerve centers of the medulla.

Action of Diphtheria Poison on the Heart.—F. Rolly, first assistant to the children's clinic at Heidelberg, as the result of a series of experiments on animals with the diphtheria toxin,[1] concludes that:—

1. The fall in blood-pressure induced by the poison of diphtheria is due to paralysis of the vasomotor center, and also to the paralysis of the heart, which in spite of artificial respiration soon ceases to beat.

2. This action on the heart is direct, and in warm-blooded animals is independent of the nervous system.

3. The paralysis of the heart develops after a more or less definite latent period. Direct injection of the diphtherial poison or transfusion of lethal diphtherial blood interferes with the action of the isolated normal rabbit's heart only after a certain latent period.

4. On the other hand, the action of the poison takes place at the same time, even if, before the appearance of poisonous symptoms or at the beginning of such toxic action, the heart is washed out with normal blood.

5. This property possessed by the diphtheria poison of action on the heart leads to the opinion that the poison gradually takes hold of the heart muscles, and is seemingly stored up there until its complete action is manifest; this further explains the continuance of functional heart disturbances after many of the acute infections.

Symptoms and Course.—Considering the clinical picture of this disease, the following classification would appear most plausible:—

1. *Local diphtheria (mild).*
2. *Diphtheria with constitutional symptoms (severe).*
3. *Septic diphtheria (usually fatal).*

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[1] "Archiv für experimentelle Pathologie u. Pharmakologie," 42, 1899.

Local diphtheria usually commences with symptoms of malaise. The appetite is poor; the tongue is coated, and the lymph glands at both sides of the jaw are swollen. The pharynx is reddened. The mucous membrane is swollen and the tonsils are covered with small, grayish yellow plaques, which adhere very firmly. On attempting to remove a piece of membrane a bleeding surface remains. This membrane peels off gradually, but leaves a red line of demarcation on the tonsils. A close study of the tonsil will show the former size of this pseudo-membrane. Usually the color of the pharynx returns to normal; sometimes it is rather anæmic, and after a few days the scar will show the presence of the former affection. When, however, this condition does not resolve in a few days, then there is always danger of a systemic infection. A small apparently innocent patch on the tonsil or pharynx should be as vigorously treated as a general septic infection. In other words the danger of a small patch extending to the larynx should not be forgotten. Other forms of local affections are: Sometimes the lips or the nose, the mucous membrane of the mouth, the tongue, the vagina, or the skin are the seat of a diphtheritic infection. Not infrequently diphtheria affects the umbilicus. Such diphtheritic omphalitis is exceedingly dangerous and frequently fatal. Rhinitis, especially in young infants, is frequently a diphtheritic process, although resembling an ordinary "cold in the head." The sudden appearance of croup will frequently cause a fatal termination if neglected.

Diphtheria with Constitutional Symptoms.—This condition usually commences with fever. The temperature varies between 101° to 102° F. If children are old enough they will complain of chills. It is not uncommon to have convulsions. The cheeks are usually flushed, in some instances they are very pale. The mucous membrane of the mouth is reddened. The pharynx has a dark red color. The tonsils are swollen. Both tonsils are intensely congested and covered with a yellowish or yellowish-gray membrane. The uvula is usually involved. There is pain on swallowing and a decided nasal tone of voice. The submaxillary glands are swollen. The nose discharges an acrid fluid containing yellowish shreds or flakes. In many cases after careful treatment the appetite returns. The diphtheritic patches are limited in area. The intense swelling and congestion fades. The mucous membrane appears and the swelling of the submaxillary glands subsides, so that conditions resume their normal state. On the other hand the affection may spread from the pharynx and involve the velum palatinum and extend downward so that the larynx is involved, causing stenosis and other serious symptoms.

Nasal Diphtheria.—When the local affection is confined to the nose, the outlook is not good. *It is important to remember that no form of diphtheria is more fatal than the nasal variety.*

When there is a general infection, then greater attention should be paid to the condition of the *heart.* The pulse is usually small and thready. The heart sounds are feeble; sometimes they are muffled. In other instances there is a tachycardia. The extremities are usually cold. If these symptoms do not subside, and the affection spreads, then there may be later a total absence of the patellar reflexes. There may also be vomiting, a decided apathetic condition, and a slowing of the heart's action (bradycardia).

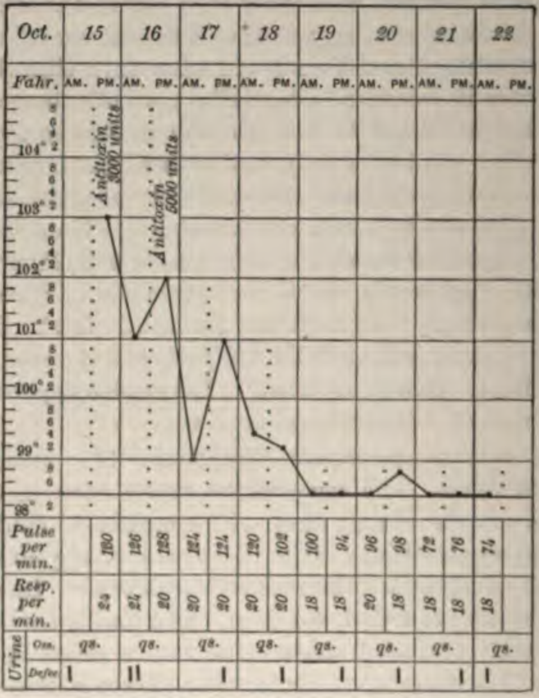


Fig. 167.—Case of Nasal Diphtheria. George P. Willard Parker Hospital. Injected with 3000 units of antitoxin on the 15th, and 5000 on the 17th. (Original.)

George P.,—age 7½ years, admitted to the Willard Parker Hospital Oct. 15; ill two days. General condition, fair. No pseudo-membrane was visible in the throat. The cervical glands were very much enlarged. There was a serosanguineous discharge from the nose; besides, the entrance to the nostrils appeared angry and excoriated. Bacteriological examination showed Klebs-Loeffler bacilli. Patient was allowed out of bed October 22.

The liver is usually very much enlarged and feels very hard on palpation. In other cases there will be marked diminution in the quantity of urine. When urine is scanty and contains casts and blood, showing a diffuse nephritis, then it is not rare to find convulsions of a uræmic character, resulting fatally. The sudden appearance of diarrhœa is frequently a very serious symptom, resulting in collapse and ending fatally.

In other instances continuous crying may be the forerunner of earache resulting in suppuration. Not infrequently moist râles and bronchial breathing show evidences of broncho-pneumonic areas in the lungs, so that the general infection of a child with diphtheria should be dreaded, owing to the danger of complications associating themselves with the primary condition.

Septic Diphtheria.—Frequently a pharyngeal affection in septic diphtheria will assume a decided gangrenous character. If this gangrenous state appears, we will find the pharynx to be the seat of a putrid, smeary exudate covering the tonsils and the velum palatinum. From the nose a sanious, foul-smelling discharge exudes. The lips appear chapped and bloody. The tongue is shining and dry. The submaxillary glands are very much swollen. The children appear puffed, and the face has a pale, waxy appearance. The extremities are cool. The heart sounds are weak, sometimes inaudible. The pulse is small, sometimes thready, and can be counted with difficulty. There is severe constipation, rarely diarrhœa. The brain is clear, although the children appear in a semi-comatose condition, moaning and with mouth open. The urine is diminished and con-

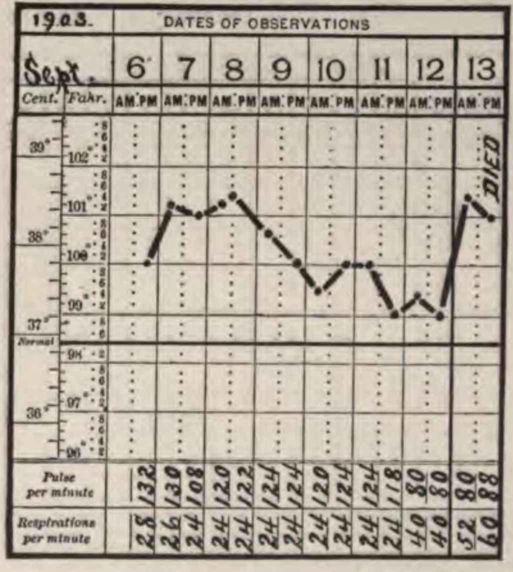


Fig. 168.—Septic Type of Diphtheria Complicated by Myocarditis. The effect of the poison is shown on the heart. Note the pulse-rate, low temperature and the respiration. (Original.)

tains albumin and also epithelium. There is a general apathetic condition, and the cardiac weakness increases until the fatal termination. In other instances there is a decided hæmorrhagic tendency. Hæmorrhagic spots appear on the skin. The urine is bloody. The stools contain blood.

Epistaxis is frequent. There is a general somnolence. A tendency to collapse, ending fatally.

Follicular Forms of Diphtheria.

We are frequently called to see children having follicular tonsillitis. Such children should be isolated, and treated as though we were dealing with true diphtheria. Every follicular inflammation in the tonsil should be looked upon with suspicion. It is necessary to take a culture to see if the Klebs-Loeffler bacilli are present. It is well to remember that diphtheria frequently manifests itself in the form of a follicular infection in which the disease is confined to the lacunæ of the tonsil. (See colored illustration.)

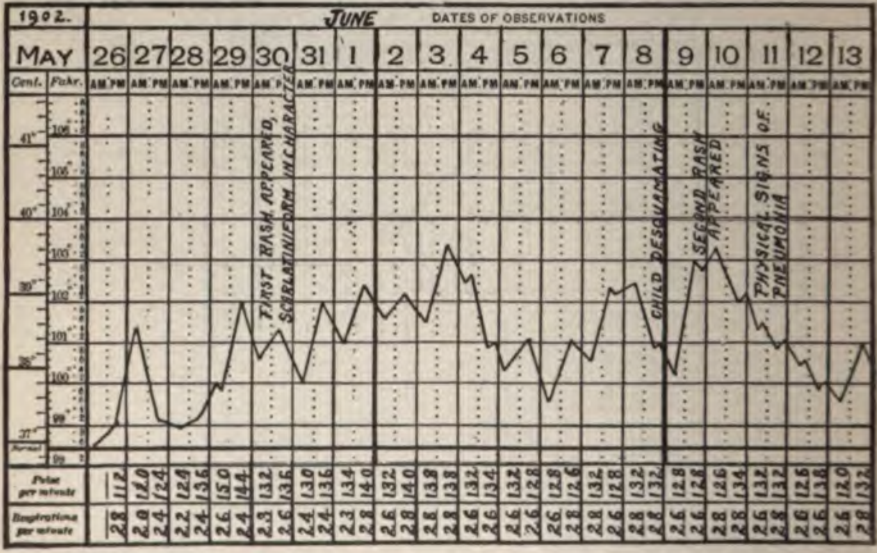


Fig. 169.—Broncho-pneumonia Complicating Diphtheria. Antitoxin rash scarlatinal in character appeared four days after injection. Second eruption appeared ten days later. Note peculiarity of temperature curve. Severe croup required intubation. Child remained well for thirty-two days after second intubation, then severe croup appeared and required intubation. In all seven intubations were required. Child discharged cured. (Original.)

When the disease is confined to the crypts or follicles of the tonsils, then, clinically, this diphtheritic infection *resembles* that form of non-diphtheritic tonsillitis which is commonly called *quinsy*.

PLATE XV

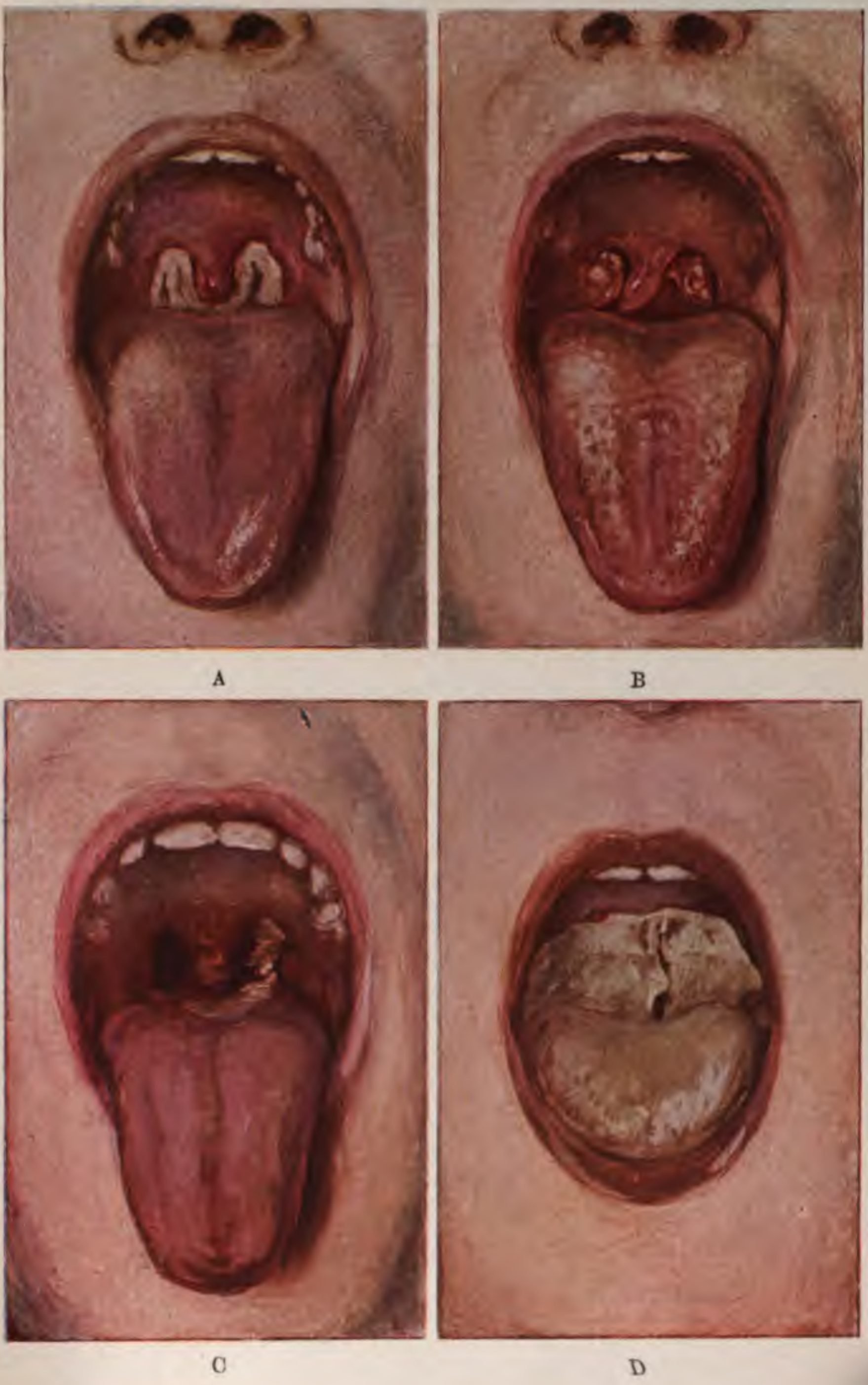
CASE A.—COMMON TYPE OF DIPHTHERIA. Child three years old. Seen on fourth day of illness at the Willard Parker Hospital. Exudate covering tonsils, pharynx, and uvula. Received in all 16,000 units of antitoxin. Throat clear on sixth day. Case discharged cured. (Original.)

CASE B.—FOLLICULAR TYPE OF DIPHTHERIA. Child seven years old. Seen on second day of illness at the Willard Parker Hospital. The membrane involved the lacunæ of the tonsils. Note the close resemblance to follicular tonsillitis. Received in all 6,000 units of antitoxin. (Original.)

CASE C.—HÆMORRHAGIC TYPE OF DIPHTHERIA. Child seven and one-half years old. Seen on sixth day of illness at the Willard Parker Hospital. Tonsillar and post-pharyngeal exudate. Severe nasal and post-pharyngeal hæmorrhages during exfoliation of membrane. Received in all 15,000 units of antitoxin. Throat clear on ninth day of illness. Myocarditis developed. Case discharged cured four weeks after admission. (Original.)

CASE D.—SEPTIC TYPE OF DIPHTHERIA. Child eight years old. Seen on the fifth day of illness at the Willard Parker Hospital. The pseudomembrane in this case covered the hard palate and extended in one large mass down the pharynx, completely hiding the tonsils. (Original.)

PLATE XV



A

B

C

D

Whether diphtheria affects the pharynx, the larynx, or the crypts of the tonsils, the disease is diphtheria, and the treatment should be aimed at limiting the disease to prevent toxæmic conditions and complications.

Rashes.—Very frequently rashes follow the injection. of antitoxin. These rashes are of an erythematous character: —

(a) Scarlatiniform. (b) Morbilliform. (c) Urticarial.

In a report made by the Investigating Committee of the Clinical Society of London, of 633 cases, there were rashes in 220, or 34.7 per cent. Of these the rash was:—

Erythematous	161
Urticarial	37
Mixed	17
Petechial	5

The following series of cases were noted by Dr. Burckhalter at the Willard Parker Hospital during my service:—

TABLE NO. 76.

April, 1903		May, 1903		June, 1903		July, 1903	
Total Cases . . . 117 Died . . . . . 29 Discharged 6		Total Cases . . 130 Died . . . 29 Discharged . . 9		Total Cases 131 Died . . . . 25 Discharged . . 12		Total Cases . . . 101 Died . . 17 Discharged . . . 15 Transf'd[1] . . . . 2 Tracheotomy . . 1	
Total Tube Cases, 35		Total Tube Cases, 38		Total Tube Cases, 37		Total Tube Cases, 34	
No. of Rashes.	Days After Injection.	No. of Rashes.	Days After Injection.	No. of Rashes.	Days After Injection.	No. of Rashes.	Days After Injection.
8	2	6	2	18	2	1	20minutes
8	3	11	3	10	3	1	6 hours
1	4	5	4	3	4	10	2 days
4	5	4	5	4	5	6	3 "
1	6	2	6	1	7	5	4 "
2	7	1	7	1	8	3	5 "
2	8	1	8	2	9	4	6 "
2	10	2	10	2	11	1	8 "
1	12	1	11	41 Rashes		2	9 "
1	18	1	12			1	10 "
1	19	1	14			34 Rashes	
1	26	1	15				
32 Rashes		1	19				
		1	26				
		38 Rashes					
Largest Number, 8 each on 2d and 3d Days		Largest Number, 11 on 3d Day		Largest Number, 18 on 2d Day		Largest Number, 10 on 2d Day	
Total Number of Cases, 479. Total Rashes, 145=32.08%.							

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[1] Transferred to Riverside Hospital, New York.

C. Hartung quotes a number of European observers who found an antitoxin rash in 11.4 per cent. out of 2661 cases. Berg found the rash in 82 cases out of 337 or 24 per cent. This condition is described in detail in Nothnagel's Encyclopædia, pages 153-162.

While Northrup reports 147 cases of rash occurring between the seventh and twelfth day, other observers report the rash as occurring much earlier. In the series above reported the largest number of rashes occurred on the second and third day after the injection. I have frequently seen an antitoxin rash several hours after the injection was given, while the majority of rashes were fully developed on the second day.

The following case illustrates the rapidity with which a rash may appear:—

Laurence S., aged 4 years. Admitted September 8, 1903, to the Willard Parker Hospital, on the third day of illness. He was in a poor condition when admitted. He was intubated about one-half hour before being admitted to the hospital. Slight retraction present. Membranes on right tonsil. Profuse nasal discharge.

The physical examination was negative. The heart regular and of good force; 4000 units of antitoxin, of serum (horse) 220, were given when admitted. There was no rash present when the antitoxin was injected. *Seven minutes after the antitoxin injection* the patient had a profuse rash all over the chest, extending from the fifth ribs to clavicles. The rash and flush were most marked in the area corresponding to the place of injection. The tongue was heavily coated. Could not take much nourishment. Grew gradually worse. Died September 9th.

Site of the Eruption.—A large flush is frequently seen on the parts around the point of injection, from whence it spreads over the body. It is most frequently seen, however, on the abdomen, chest, and buttocks; less frequently at the wrists, knees, and ankles. The face and neck are seldom involved. It sometimes covers the back as well as the buttocks. There is intense itching and occasionally the children complain of intense pain in the joints.

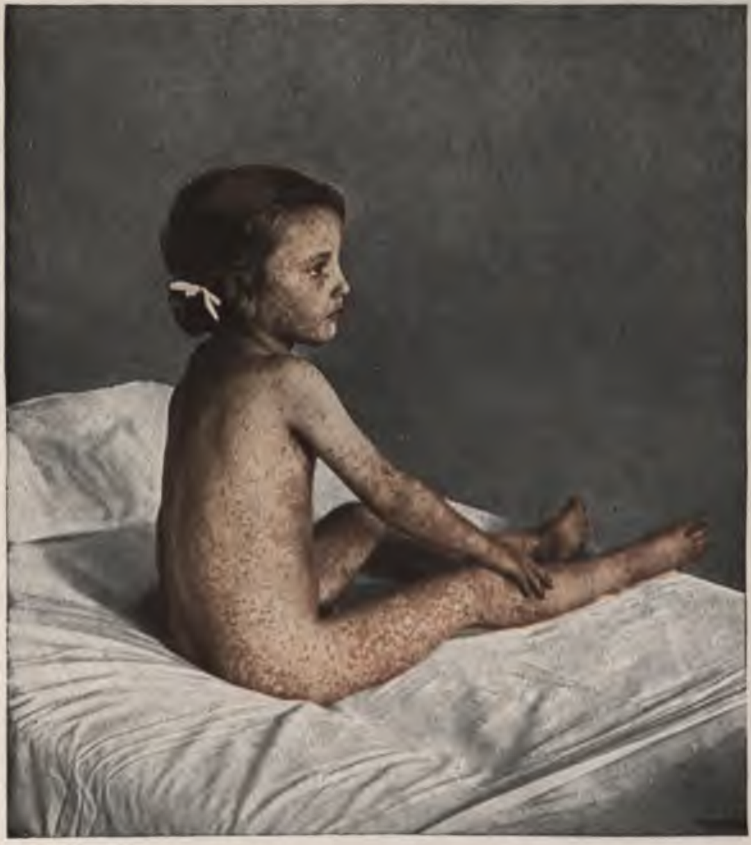
Fever usually precedes the eruption.

Constitutional symptoms, such as vomiting, diarrhœa, headache, muscular pains, and general malaise are noted. Not infrequently when hyperpyrexia exists there is delirium or convulsions (Sevestre and Martin).

Desquamation.—A very fine mealy desquamation follows the antitoxin rash. It is similar to the measles desquamation (Berg). A rash resembling measles never has the catarrhal symptoms which we always note in genuine measles. If, however, we are in doubt regarding the true nature of the rash, it is well to isolate and await results rather than to expose children to the risk of infection.

Diagnosis.—The diagnosis of diphtheria affecting the pharynx, tonsils, and nares with visible membranes is quite easily made. When, however, the disease affects the lower respiratory tract, the larynx, trachea, or bronchi, the diagnosis will be rendered more difficult. The crucial test con-

PLATE XVI



Lizzie F., 5 years old, was admitted to the Willard Parker Hospital in September, 1904. She was ill seven days before admission. Diphtheria was present on both tonsils. There was slight glandular swelling. The general systemic condition was poor. The temperature was 101° F., pulse 126, respiration 24. The child received 5000 units of antitoxin on admission, and on the following day a second injection of 4000 units. Four days after the second injection of antitoxin, the throat cleared so that no membrane was visible. Two days later, or six days after the second antitoxin injection, a universal rash appeared on the face, chest, abdomen, back, and extremities. This rash was morbilliform in character and persisted for twenty-two days, although it was chiefly confined to the arms and legs. No complications followed. The child left the hospital in excellent condition. (Original.)

sists in taking a culture and noting the bacteriological result. The presence of the Klebs-Loeffler bacillus means diphtheria.

We must not infer that if the Klebs-Loeffler bacillus is not found that our case is of a non-diphtheritic character. A technical error, such as swabbing a healthy surface instead of an infected area, may be the cause of a negative result. *Not infrequently in the most malignant forms of diphtheria, nothing but a streptococcus can be found. This is especially true when complications such as broncho-pneumonia are met with.*

Bacteriological Diagnosis.—Directions for Inoculating Culture Tubes with the Exudate in Cases of Suspected Diphtheria: The child should be placed in a good light, and properly held. Remove the swab from its tube. Depress the tongue with a spoon in the left hand. With the swab in the right hand rub firmly but gently against any visible membrane on the tonsils or in the pharynx. Withdraw the cotton plug from the culture tube. Insert the swab, and rub it thoroughly but gently back and forth over the entire surface of the blood serum. Do not allow the swab to touch anything except the throat of the patient and the surface of the serum. Do not push the swab into the serum or break the surface in any way. Replace the swab in its own tube; plug both tubes; fill out the blank forms which accompany each tube, and send to a culture station.[1]

If there is no visible membrane (it may be present in the nose or pharynx) the swab should be thoroughly rubbed over the mucous membrane of the pharynx and tonsils, and in nasal cases, when possible, a culture should also be made from the nose. In little children care should be taken not to use the swab when the throat contains food or vomited matter, as then the bacterial examination is rendered more difficult. Under no consideration should any attempt be made to collect the material shortly after the application of disinfectants (especially solutions of corrosive sublimate) to the throat. If any of these instructions have not been carried out the fact should be carefully noted on the record blank.

Welch says: "The mere presence of the diphtheria bacilli in the throat of a patient no more proves that he has diphtheria then the presence of the pneumococcus in his saliva establishes the fact that he has pneumonia. The only decisive method, as claimed with much justice by Runge, is control experiments in the way of animal inoculations."

If a croupy cough is heard and associated with it a small diphtheritic membrane is seen on the tonsils, pharynx, or in the nose, the diagnosis of diphtheria can positively be made.

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[1] The New York Department of Health has a series of culture stations in various drug stores. At these stations sterile culture tubes are supplied to the physician and the same are also collected daily after inoculation. The Department of Health furnishes material, including examination and report, free of charge.

Differential Diagnosis.—In the very beginning of the disease, before the appearance of a pseudo-membrane, the diagnosis is beset with difficulty. Thus, an acute catarrhal angina will show symptoms similar to those of diphtheria.

Pre-membranous Stage.—If seen early the throat is usually intensely congested and reddened. It may be a day or two before the membrane will be visible. The disease is, *primarily, a local disease.* The systemic infection which accompanies the same is due to the absorption of the toxins thrown out by the micro-organisms present in these pseudo-membranes.

Thrush sometimes resembles diphtheria, but can be differentiated by the fact that the small whitish spots resembling curdled milk are scattered over the cheeks, lips, tongue, and gums, in addition to the uvula and pharynx.

Ulcerative tonsillitis[1] resembling diphtheria has been described by Vincent. In this condition there is no tendency to spread. There is an absence of croup, and a culture taken shows the Vincent bacillus instead of the Klebs-Loeffler bacillus.

Peritonsillar Abscess.—In this condition we meet with a swelling or bulging forward of the affected parts. The uvula is sometimes displaced. There are very many active local symptoms, such as pain and difficulty in swallowing, and a nasal tone of voice. Not infrequently when an attempt to swallow is made the fluid regurgitates through the nose. When children are old enough to describe subjective symptoms, they will complain of chills and fever. The temperature is usually high, ranging from 102° to 105° F. The active symptoms subside the moment pus is relieved. Nature frequently gives a spontaneous evacuation of the pus. At other times it is wiser to give relief by making an incision and emptying the pus. A culture taken in this condition does not show the presence of the Klebs-Loeffler bacillus.

Follicular Tonsillitis.—In this condition more than in any other form of disease we must be careful regarding a positive opinion. There are follicular forms of diphtheria involving the lacunæ of the tonsils which clinically so resemble diphtheria that even an expert cannot differentiate them.

The clinical manifestations of the benign form of follicular tonsillitis have already been described in the article on "Follicular Tonsillitis."

The differential diagnosis depends on the presence or absence of the Klebs-Loeffler bacillus.

Complications.[2]—The most frequent complication met with is *broncho-pneumonia.* More deaths occur from this than from any other complication. It is usually the extension of the disease from the larynx to the bronchi. When a septic form of diphtheria exists broncho-pneumonia usually accompanies it. (See chapter on "Pneumonia.")

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[1] Read article on "Tonsillitis."

[2] For a detailed description of the various complications, the reader is referred to the special chapters on "Otitis," "Empyema," etc.

Pleurisy with serous effusion frequently complicates this disease.

Empyema not infrequently complicates. A number of these cases have been seen by me during my service at the Willard Parker Hospital.

Otitis is occasionally met with as a complication of diphtheria. It is usually the result of a streptococcus infection through the nose or throat into the Eustachian tube.

Myocarditis is the most frequent form of heart complication met with in diphtheria.

Endocarditis and pericarditis are also seen in severe types of this disease.

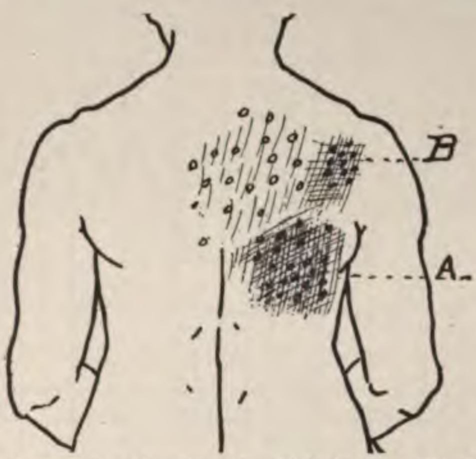

Fig. 170.—Pneumonia Complicating Diphtheria. (Kind assistance of Dr. Edward H. Sparkman, Jr., at the Willard Parker Hospital.) *A.*—Starting point of pneumonia showing extent on third day. *B.*—Focus which developed three days after *(A)* showing extent on third day of the new focus. (Original.)

Meningitis is not often seen, though I have seen 3 such cases out of a total of 35 at the Willard Parker Hospital, during my service. About 10 per cent. of all septic cases have meningitis.

Cerebral thrombosis and embolism occasionally complicate diphtheria, and result in hæmiplegia, convulsions, or aphasia.

Thrombosis of the pulmonary artery of the heart may cause sudden death. This is usually accompanied by feeble heart's action, the result of degenerative changes in the muscular walls (Holt).

Hæmorrhages occur quite often. Bleeding from the nose and from the ear, also blood in the urine and blood in the stools has frequently been seen by me. These cases are of the most severe type and usually end fatally.

Purpuric spots similar to that form of purpura met with in rheumatism were seen by me in septic cases, all of which ended fatally.

Nephritis[1] is usually met with in septic cases, although it may follow as a complication of the milder form of this disease. Traces of albumin are frequently found during the course of diphtheria. This does not necessarily imply that we are dealing with nephritis. The presence of casts in addition to the albumin, or possibly blood, is necessary to strengthen the diagnosis of nephritis.

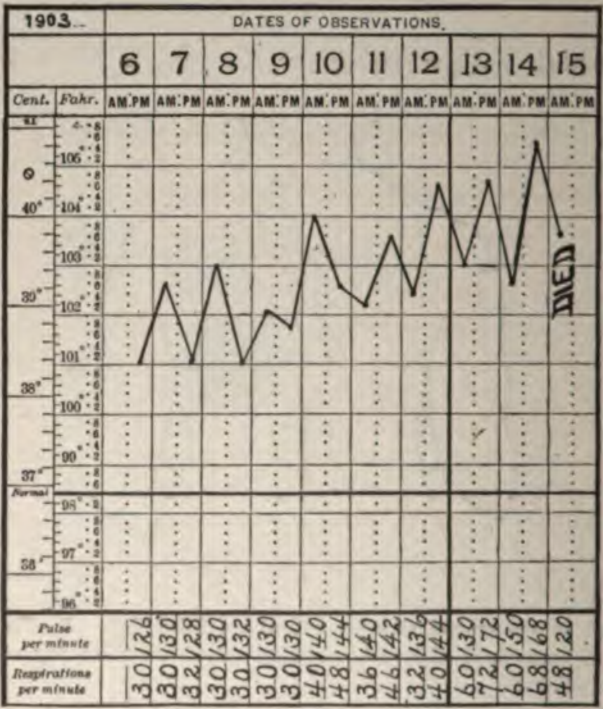

Fig. 171.—Temperature Chart from a Case of Diphtheria complicated by Broncho-pneumonia (Step-ladder Type of Fever). (Original.)

Diarrhœa due to a follicular ileo-colitis or acute gastric catarrh frequently complicates diphtheria.

Diphtheritic Gastritis.—When membranous gastritis occurs it is usually a diphtheritic gastritis.

Diphtheritic omphalitis is described in Chapter III, Part II.

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[1] An excellent illustration of nephritis complicating diphtheria is described in the article on "Nephritis."

When *membranous enteritis* complicates diphtheria it is usually the result of a streptococcus or Klebs-Loeffler infection.

Profound anæmia usually follows diphtheria. This is due to the effect of the toxins in the blood causing the destruction of the red corpuscles.

Post-diphtheritic Paralysis.—Toxæmia caused by absorption of the toxins generated by the Klebs-Loeffler bacillus, if not neutralized either by an injection of antitoxin or by Nature's own production of antitoxin, frequently causes paralysis. This paralysis usually affects individual muscles or groups of muscles. In this manner the heart, which is a muscular organ, is frequently paralyzed, resulting in death. When the toxin affects the respiratory centers it may result in paralysis, causing death by asphyxia. In addition to the paralytic effect of this toxin on the muscles and nerves, degenerative changes are brought about by the influence of this poison. Thus it is that the toxin in the system will frequently irritate an otherwise healthy kidney and set up a toxic nephritis.

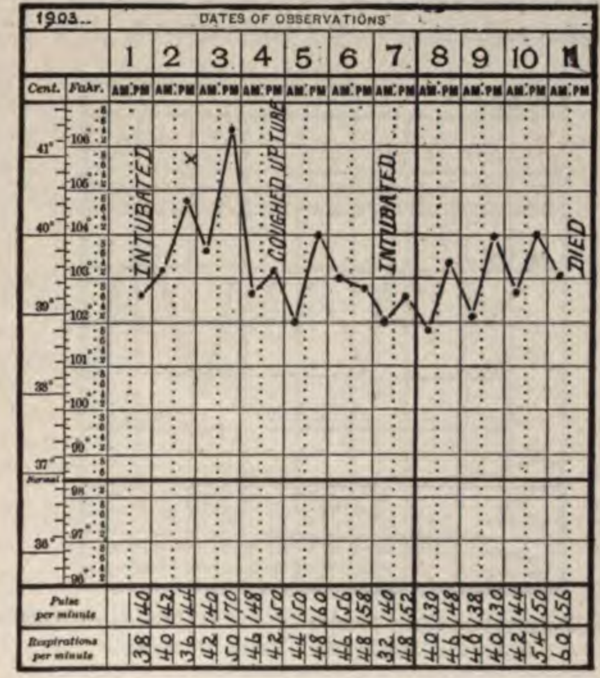

Fig. 172.—Temperature Chart from a Case of Diphtheria complicated by Lobar Pneumonia. (Original.)

From the foregoing we can see that the poison generated by the Klebs-Loeffler bacillus is certainly a serious factor which must be dealt with very energetically.

A study of recorded cases of paralysis shows that between 10 and 30 per cent. of all cases of diphtheria are followed by paralysis. Woodward studied 7832 cases of diphtheria; of these 1362 had post-diphtheritic paralysis. Myers, in the *London Lancet*, 1900, studied 1316 cases of the disease, in which 275 cases, or about 21 per cent., had palsy.

110 cases affected the palate,
69 cases were cardiac,
21 cases diaphragmatic.

There are four palsies due to severe toxæmia; they occur in the following order: palatal, ocular. cardiac, and diaphragmatic.

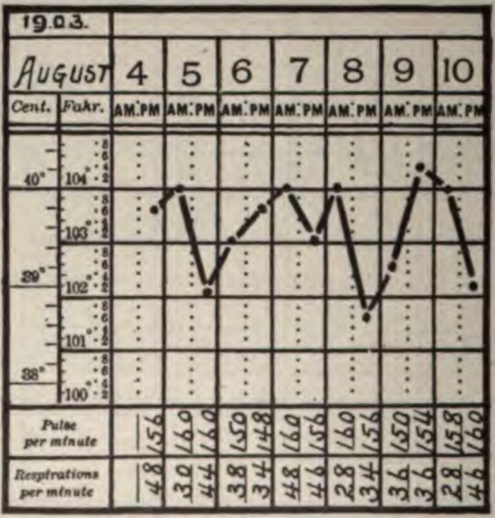

Fig. 173.—Temperature Chart from a Case of Diphtheria complicated by Otitis and Meningitis. Fatal. (Original.)

Paralysis is most frequently found in children between the second and sixth years. Usually during the second week following diphtheria, when the child is convalescent, emaciation of the extremities will be noticed. If the muscles of the trunk are involved, there will be emaciation of the thoracic muscles, regurgitation of liquids through the nose, and a nasal twang in the voice. There is marked difficulty in walking or climbing stairs in other cases; the child waddles and appears weak, falls easily, and staggers as in ataxia. In severe cases the child is unable to raise its head. The sphincter of the rectum and bladder may become paralyzed, resulting in involuntary urination or obstinate constipation.

Paralysis of the extremities may be added to paralysis of the respiratory muscles or of the heart. The knee-jerk may be diminished or absent. The absence of the knee-jerk indicates some change in the peripheral neuron. The *special heart symptoms* indicating cardiac paralysis are irregularity of heart's action or a gallop rhythm, bradycardia, tachycardia, lowering of the temperature (usually subnormal), vomiting; dilatation of the heart, a short first sound with systolic murmur at apex, blueness of the lips, and cold extremities.

"Monicatide divided diphtheritic paralysis into four groups: Those showing (1) purely muscular change without nerve involvement; (2) polyneuritis; (3) lesions of the spinal cord, which were either localized in the gray matter, leading to atrophy of muscles, or involved the white matter of the cord in a similar way to that seen in locomotor ataxia or multiple sclerosis, and (4) cerebral hæmorrhage chiefly due to circulatory change. This classification is accepted by many of to-day. To be scientifically correct, however, the fourth group, *i.e.*, the cerebral palsies, should not be classed as a palsy due to a diphtheritic toxin, inasmuch as they are accidental. Strictly speaking the term diphtheritic palsy should be applied to those palsies only which are due to direct action of the diphtheritic toxin."

A child, 4 years old, was seen during my service at the Willard Parker Hospital. He had suffered with severe tonsillar and pharyngeal diphtheria. The exudate was unusually thick. The resident physician called my attention to a regurgitation of the liquids through the nose and to the nasal twang in speaking. On examining the throat, all evidences of diphtheria had disappeared. The tip of the uvula, instead of hanging in the median line, pointed toward the left side. As this case was a severe type of diphtheria we were not surprised to see the paralysis. Strychnine was given. The case recovered.

When diphtheria has preceded an attack of paralysis, the diagnosis is easily made. Emaciation is general as a rule and not confined to a simple group of muscles.

The disease is sometimes mistaken for acute anterior poliomyelitis. The onset of the latter is sudden and is usually preceded by fever. The absence of a history of diphtheria aids in establishing the diagnosis.

In 275 cases reported by Myers, 80 died, or 29 per cent.

Course.—A mild case of diphtheria will show exfoliation of the exudate on the tonsils and pharynx about twenty-four to forty-eight hours after a sufficient dose of antitoxin has been injected. In four or five days after the beginning of illness, the disease usually disappears, so that there is no visible evidence of the same.

In a severe case[1] (male, 8 years old) seen by me in October, 1904, in the wards of the Willard Parker Hospital, the exudate completely covered the fauces. The

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[1] The colored illustration D, Plate XV, was drawn from this case at the bedside in the Willard Parker Hospital.

tonsils, uvula, and pharynx were covered with one large mass of pseudo-membranes. The cervical glands were very much enlarged. The case looked decidedly septic. An injection of 5000 units of antitoxin was given on the first day, soon after admission to the hospital. A second injection of 5000 units was given on the second day. A third injection of 5000 units was given on the third day. A fourth injection of 5000 units was given on the fourth day, so that 20,000 units were administered during the first four days after admission to the hospital. The membrane exfoliated, the swelling of the glands disappeared and one week after his admission, the throat was clear and he was convalescent.[2]

A mild case of diphtheria may last from five to eight days. Severe types may last many weeks. No case of diphtheria should be considered to have run its course until the heart's action is normal and the general condition good. Sudden death may come from over-exciting a weakened or damaged heart if proper caution is not used.

Prognosis.—The uncertainty of this disease and the ease with which complications follow must be taken into consideration in giving the prognosis in a given case of diphtheria. A child suffering from diphtheria, who was brought up in unsanitary surroundings or one deprived of breast-milk, will suffer much more than one favored with the opposite conditions. Such factors are important in giving an opinion. A child with rickets is more liable to succumb to an infection from diphtheria and may possibly die, when a child with a strong normal body and healthy internal organs will recover. In this disease we therefore note that it is the "survival of the fittest." When diphtheria follows typhoid, or when it is a complication of a severe systemic infection, like scarlet fever, then great care should be exercised in venturing an opinion as to the probable outcome of the attack.

The guide in estimating the prognosis of any case of diphtheria should always be the condition of the heart. A very rapid pulse or a gradually increasing pulse-rate are bad signs. The temperature cannot be looked upon as the most impotant factor in determining the outcome of this condition. I have seen cases of diphtheria in hospital as well as in private practice where *normal temperatures prevailed* and still septic conditions were positive. Such cases, showing a low inflammatory type having slight elevations of temperature, *rarely recover.* The prognosis is also influenced by the time at which the treatment was commenced. When antitoxin is injected on the first or second day of the disease the outcome is brighter naturally than when the disease extends without specific treatment. The mortality is greatest in children under 2 years of age.

Prophylaxis.—In no disease should we be more careful than in diphtheria. Strict isolation of all cases should be enforced, so that no transmission of the disease can take place. Disinfection of infected clothing, bedding, etc., should be strictly carried out. Read article on "Disinfection," page 934.

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[2] This case was reported by me at a meeting of the New York State Medical Association held October 19, 1904.

Visitors should never be permitted in a room where diphtheria exists.

The vital point to be considered is how to prevent complications. The question arises: can complications be prevented by proper treatment? We certainly can if treatment is commenced early in the disease. We must carefully watch all the functions of the body and stimulate those that do not seem to act. The emunctories are the most important which require watching. If the kidneys are found secreting very small quantities of urine, then we can be reasonably sure that the toxins stored in the kidneys will cause serious damage. When therefore a scanty secretion of urine is met with it will at once call for active diuretic treatment. The rule I have always followed is to *stimulate with mild diuretic treatment* from the beginning, and secure a copious secretion of urine. The same is true regarding the condition of the bowels. In no disease is it as important to have food assimilated and to have proper evacuation as in the course of the treatment of diphtheria.

We eliminate large quantities of toxins by the bowel, the skin, and the kidneys, hence we have it in our means to hasten recovery and at the same time we guard against storing up poison in the blood.

The clothing should be warm. The child should not be exposed while bathing. We must guard against draughts, as we know there is a peculiar predilection for pneumonia in the course of diphtheria. The urine must frequently be examined. The examination must not only be chemical, but microscopical. The moment we find our case complicated by nephritis, the same should be given proper attention.

Isolation.—Very frequently children have Klebs-Loeffler bacilli in the throat—so-called culture cases—in the pre-membranous stage of the disease. Some of these develop diphtheria of the most virulent type. A safe rule therefore is to *insist on the isolation of every child having the Klebs-Loeffler bacillus in the secretions of the nose and throat,* for weeks and months if necessary, until a swab from the throat shows an absence of the Klebs-Loeffler bacillus, to guard against possible development of fatal diphtheria.

The finding of diphtheria bacilli in the throat without marked clinical indications of diphtheria, has no significance, according to Behring.[1]

He asserts that about 10 per cent. of the entire population carry diphtheria bacilli in their throats without resulting infection. The bacilli have lost their virulence, or else the individual possesses a natural immunity. He considers all bacteria with the morphological characteristics of Loeffler's bacillus, true diphtheria bacilli, but he would differentiate a simple angina, rhinitis, or conjunctivitis from diphtheria, even with diphtheria bacilli numerous in the organ involved, if there were no general symptoms of diphtheria. He affirms that it is useless and nonsensical to isolate persons who have been exposed to diphtheria. It is impossible to free people from the bacilli or to keep them permanently free. Infection results from a predisposition, which is in turn due to a lack of antitoxic serum in the blood. The antibodies which undoubtedly exist in the blood of numerous individual are probably produced by the vital activity of avirulent diphtheria bacilli in their throats. He consequently suggests that it might be possible to induce auto-immunization by transplanting avirulent diphtheria bacilli into the throats of other human beings. The comparative immunity of physician to diphtheria may be due to the repeated, unconscious inoculation with small doses of the virus. Extensive, systematic preventive inoculation with antitoxin would induce a natural immunity to the disease and entail the final disappearance of diphtheria.

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[1] Therapie der Gegenwart (Berlin).

While the view maintained by Behring is interesting, it certainly does not conform to modern clinical experience. No child should be permitted at large with diphtheria bacilli, owing to the possible fatal result entailed thereby.

Immunization in Diphtheria.- Immunity in the Nursling: There seem to be an immunity conferred upon the nursling. This may be due to the anti-toxic properties of serum contained in the mother's milk.

Diphtheria rarely attacks nurslings, but most frequently attacks infants brought up by hand feeding—the bottle babies. It is most frequently met with between the second and eighth years. The disease may recur and has been known to attack patients three or four and even more times.

How to Immunize. When a case of diphtheria occurs in a family in which there are apparently very healthy children, then immunity can be conferred upon them by giving an injection of antitoxin. This immunity is in the nature of prophylactic treatment. The average dose required for a child from 1 to 5 years is 300 to 400 units. For older children, from 5 to 12 years, between 400 and 500 antitoxin units may be injected. No further treatment will be necessary after the injection. All aseptic precautions which are described in the chapter on the "Injection of Antitoxin" must be used whether we inject a large or a small dose of antitoxin. It must not be supposed that because an immunizing dose of antitoxin has been injected, that such a child may then be exposed to this disease with impunity. Experience has shown that when children have been given an immunizing dose of antitoxin and are immediately isolated, as a rule they do not take the disease. On the other hand, *if children are permitted to remain in the same room with a case of malignant diphtheria, it is quite plausible to assume that they will take the disease, even though an* *immunizing dose of serum has been injected.* Immunity is usually conferred for a period of two or three weeks. It is a good plan to repeat this same immunizing dose of antitoxin if diphtheria still prevails in the household three weeks after the first injection has been given. Children receiving an immunizing dose should be treated as though they were perfectly well children. There should be no restriction to their diet and they should be permitted to romp and play in the open air, and receive their bath just as though no injection had been given.

The New York Board of Health reported a series of immunizing injections in 6806 individuals, given by their inspectors from January 1, 1895, to January 1, 1900. Out of the above number, 18 contracted diphtheria of a mild type; 1 contracted diphtheria complicated with scarlet fever; total, 19 cases; the last case of scarlet fever ending fatally. The New York Board of Health Division of Bacteriology, from January, 1898, to January, 1900, reports 682 cases of diphtheria which were secondary to an original case in the same family. Under secondary are included only those cases which occurred at least twenty-four hours after and within thirty days of the primary case. Of these 682 cases, 61 died, a mortality of 8.9 per cent. Had these 682 cases received antitoxin (immunizing dose) when the physician first visited the families, probably not one of them would have contracted the disease. When immunity is conferred by an injection of antitoxin it lasts about twenty days, *provided it is given twenty-four hours previous to actual exposure.*

As a rule no harm will result by the injection provided the serum used is of a standard quality. We must not expect to prevent follicular tonsillitis or any other disease by an immunizing injection of antitoxin.

Morrill reports that of 1808 children immunized at least every twenty-eight days with 150 to 500 units of serum, 7 had diphtheria; 3 from insufficient dosing, 2 within twenty-four hours of the injection, and 2 in twenty-two and twenty-three days. Of 829 who had not been given antitoxin, or in whom more than twenty-eight days elapsed after the injection, 9 had diphtheria, besides 3 immunized adults.

Biggs and Guerard, from 35 reports of 17,516 cases in which small doses of antitoxin were given as an immunizing agent, state that diphtheria occurred in 131 cases; 109 mild cases and 1 fatal case within thirty days of the date of injection; 20 mild cases and 1 fatal case after thirty days.

At the New York Infant Asylum 107 cases of diphtheria occurred between September and January, 1895 (30 cases a month). In October bacteriologic examination showed diphtheria bacilli in almost one-half of the throats.

January 16th 224 children were given immunizing doses of antitoxin, and up to February 15th only 1 case of diphtheria occurred. A second case then developed, and between February 15th and 27th, 5 cases. On the 25th 245 children received antitoxin, and no cases occurred for thirty-one days. To sum up: before isolation and immunization 107 cases occurred in one hundred and eight days; after the latter was practiced, 5 cases in one hundred and twelve days.

The occurrence of diphtheria during an epidemic of measles at the New York Foundling Hospital added greatly to the mortality of the disease. During an epidemic of measles at that institution every child was given 100 units of antitoxin. The result was most encouraging, as is shown by the immunity conferred by the injection.

In 119 cases of measles, 500 units of diphtheria antitoxin were given at the first appearance of measles symptoms. No cases of diphtheria secondary to measles occurred in any of those cases for a period of one month at least. Since the appearance of the later report another epidemic of measles has occurred at this institution. The children were given 500 units of antitoxin each, but it was apparent in a number of instances that immunity from diphtheria did not last for more than eighteen days to three weeks, at which time several cases of diphtheria occurred, complicating or following measles, and generally proved fatal. This relatively shorter period of immunity from diphtheria in measles cases has been noted in France and Germany, and for this reason Slawyk recommends that the immunizing dose be repeated every two weeks in measles epidemics.

W. P. Coues gives an account of an epidemic of diphtheria at St. Mary's Infant Asylum, in Boston, 1898. Fifty children were given doses of antitoxin, from 50 to 500 units, the small dose in a one-day infant. Urticaria occurred in 11 as the only bad result. From February 15th to March 22d there were 18 cases of diphtheria. After the latter date, when antitoxin was begun, there occurred no cases for three weeks.

Krause gives an extensive analysis of results of immunizing doses in 122 hospital cases, which were divided as follows: 11 were scarlet fever cases, 2 of which later contracted diphtheria; 31 cases of children were sent to the diphtheria pavilion and found not to have true diphtheria; no cases contracted it; 17 measles cases, many of them complicated; 1 developed diphtheria.

Thus, of 122 cases, all of whom were more or less exposed to the disease, and all ill with diseases most likely to be complicated by diphtheria, only 3 became infected, on the twenty-sixth, twenty-seventh, and forty-first day after inoculation. The dose of antitoxin ranged from 200 to 400 units, the latter being given to the children with suspected diphtheria.

In addition to the results of immunization at the New York Infant Asylum, the following report of Biggs will show the result at other institutions:—

Table No. 77.

Place of Observation	Children Immunized.	Cases of Diphtheria Developing among those Immunized between 1 and 30 days.	Cases Developing within 24 Hours.	Cases Developing after 30 Days.	Number of Cases of Diphtheria that Occurred in the Institutions Previous to Immunization.
Nursery and Child's Hospital	136	0	0	0	46 cases in 90 days; 15 cases in 18 days
New York Juvenile Asylum	81	0	0	0	12 cases; 3 cases in 2 days
New York Catholic Protectory	114	0	1	0	5 cases in 3 days
Bellevue Hospital	11	1 mild on the 19th day	3	one 30th one 31st one 55th	2 cases in 10 days. One or more cases in more than 90 families
Total. . . .	342				

Modern Treatment of Diphtheria.

The treatment of diphtheria requires careful consideration in each and every case. Certain conditions must be met; therefore it is wise to look ahead. The treatment is divided into:—

1. Hygienic.
2. Prophylactic and specific.
3. Medicinal.
4. Dietetic.

Hygienic Treatment.—Put the child to bed in a large airy room. The room must be free from draught and so arranged that proper ventilation can easily be carried out. Fresh air in the treatment of this disease is of prime importance. Pseudo-membranous deposits in the nose, pharynx, larynx, or tonsils will frequently cause a mechanical impediment to the entrance of oxygen. Carbonic acid poisoning can easily take place, and the entrance of fresh air into the lungs is of the greatest importance. In simple diphtheria, or if we have an extension of the croupous deposits into the bronchi, perfect oxygenation of the lungs is demanded. Having given attention to proper ventilation we must seek to maintain an equal temperature in the room. The temperature of the sick room should be between 65° and 72° F. The entrance of sunlight is of prime importance. When we consider the great antiseptic properties of sunshine and its beneficial effect upon the patient, then we must see the importance of admitting as much light and sunshine as possible.

The Bath.—Next in importance to fresh air and sunlight is the bath. Every patient with diphtheria should be sponged twice daily with a tepid sponge bath. The body should be briskly rubbed for a few minutes after the bath to stimulate the cutaneous circulation. By opening the pores of the skin we naturally favor elimination, hence it is advisable to encourage diaphoresis by attending to the skin.

SPECIFIC OR ANTITOXIN TREATMENT.

Manner of Administering the Antitoxin.—The greatest amount of care should be exercised in administering antitoxin. The skin of the patient, the physician's hands and the needle used should be rendered aseptic. It is a good plan to disinfect the syringe with alcohol before filling the same with the antitoxin. Abscesses need not form at the base of puncture if care and attention are bestowed to strict cleanliness.

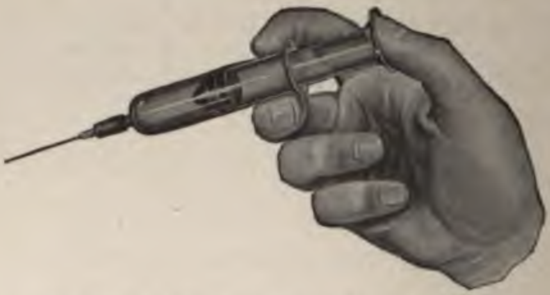

Fig. 174.—Glass Aseptic Antitoxin Syringe.

Part of the Body Chosen.—Wherever a loose fold of skin can be pinched up, for example on the thigh, the loose tissues of the abdomen, the outer portion of the chest, or between the shoulder blades, the needle should be inserted into the cellular tissue and the antitoxin gradually injected. The puncture should then be sealed with a drop of collodion. Fill the syringe with antitoxin, and *expel all air* before injecting the patient. Sudden death after the injection of antitoxin has been reported when this precaution was neglected; and air was injected into a vein.

A convenient method of injecting antitoxin is with the syringe adopted by Messrs. Mulford and Wampole. The glass barrel containing the antitoxin has an aseptic piston-rod and needle attached. This does away with an extra syringe as each dose of antitoxin is contained in one of these aseptic holders.

The Administration of Antitoxin Per Orem.—Some writers have advocated giving antitoxin by the mouth. The writer has administered antitoxin in drachm doses until a sufficient quantity of antitoxin was given. One thousand units were given in this manner, in a very mild form of diphtheria. The disease spread in spite of this administration and *there was no apparent benefit from its use.* When, however, 3000 units were given subcutaneously, the disease not only improved, but the child recovered.

Administration of Antitoxin Per Rectum.—Several years ago the writer was induced to use antitoxin in various ways. He therefore injected 2000 units into the colon. The part was first thoroughly flushed with soap and water to remove fæces, and after it was completely drained, the required dose of antitoxin was injected through a long rubber catheter. Most of the antitoxin remained and was absorbed.

Several cases of this kind were reported at a meeting of the New York County Medical Association, in 1897, by the writer. As it was impossible to control the sphincter in some cases a large portion of the antitoxin was lost. It was impossible, therefore, to state just how much of this healing serum remained and was absorbed. In several cases in which this was used an apparent benefit was manifested; on the other hand in a very malignant case in which the sphincter ani was relaxed, the antitoxin was not retained and flowed from the colon and rectum and was lost. I therefore cannot advocate the injection of antitoxin excepting by the subcutaneous method.

It is well at the onset of a case of diphtheria, be it confined to the tonsils, to a large or small area, to treat the disease as though it were much worse than it appears. Locally we see the macroscopic evidence by the presence of the pseudo-membrane. We cannot see nor can we know how much toxin has been thrown out by the Klebs-Loeffler bacillus, as the same enters the general circulation. What is recognized as a toxic condition is no more or less than a given amount of poison thrown into the system by these poisonous bacilli. Acting upon our knowledge of the bacteriology and pathology of this disease we can lay down certain rules for the guidance of any one in the treatment of diphtheria. First and foremost it is necessary to give a sufficient quantity of antitoxin to neutralize any and all poison that may be in the system.

The specific action of antitoxin is well known and universally recognized.

Dose Required.—*Mild Cases:* The dose depends on the severity of the infection. The usual amount required for a child from 1 to 5 years old with a mild form of diphtheria is 1500 to 3000 units. If there is no effect noticeable within twelve to twenty-four hours, then a second injection of the same quantity should be given. A child 5 to 10 years of age should be given at least 3000 to 5000 units at its first injection, to be followed in twelve to twenty-four hours by another injection of the same amount if there is no amelioration of the symptoms.

Severe Cases.—When we are dealing with a severe toxæmia with marked general depression and large masses of pseudo-membranes in the throat, then at least 10,000 units of antitoxin[1] should be injected in the beginning. When the cervical lymph glands are enlarged and there is slight or severe evidence of stenosis, then at least 10,000 units should be injected in the beginning.

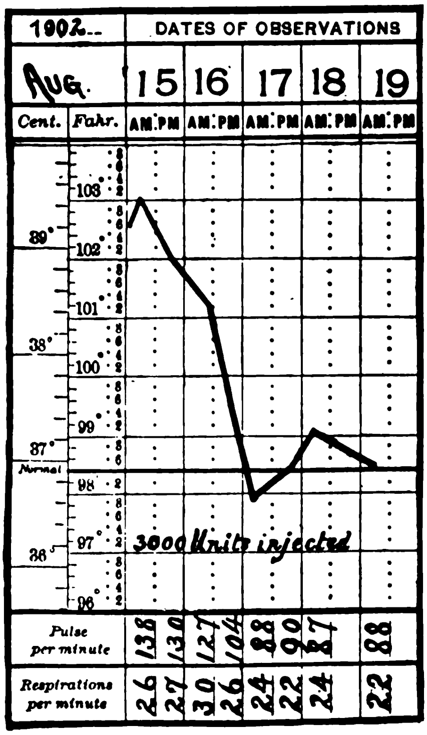

Fig. 175.—Temperature Chart from a Case of Diphtheria, showing the Specific Effect of Antitoxin on the Temperature. Note also the effect on the pulse. (Original.)

Indications for a Second and Third Injection of Antitoxin.—If twelve hours after the first injection there is no visible effect on the pseudo-membranes, if the child is not brighter, if the appetite is poor, and if the heart's action is very poor, in other words, if there is *no visible improvement,* then by all means inject a second dose of antitoxin.

The necessity for the third injection depends upon the pulse, temperature, the condition of the glands of the neck, and upon the macroscopic condition of the throat. If no improvement exists, then the third injection is imperative.

Laryngeal Stenosis.—It is always a safe plan to give an injection of 5000 units; and if the stenosis does not disappear in twelve hours, I give an additional injection of 5000 units, so that in all 10,000 units may be injected during the first twenty-four hours; (read chapter on "Intubation").

The above treatment with antitoxin will be serviceable when we are dealing with a pure Klebs-Loeffler infection, but there are a great many cases in which we have a mixed infection, and the streptococcus infection predominates.

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[1] It is frequently necessary to repeat the dose so that 10,000 units may be given during the first day of illness if no improvement is noted. The dose of 10,000 units may be repeated during the first three days if no improvement is noted. I am in favor of large doses and watch the child's condition as the guide when sufficient antitoxin has been injected.

There are contributing factors frequently leading to a fatal termination. First and foremost is the presence of the streptococcus in addition to the Klebs-Loeffler infection. In these mixed infections we have in addition to the general diphtheria, a distinct streptococcemia. In these cases antitoxin is inert as regards the streptococcus. We frequently have broncho-pneumonia, nephritis, arthritis, otitis, and local abscesses due to the invasion of the streptococcus. To neutralize such mixed infections we require besides the Klebs-Loeffler antitoxin a streptococcus antitoxin or a potent antistreptococcus serum.

The bacteriological findings will therefore be the guide in the future in determining, first, whether a culture from the throat shows a mixed or an unmixed infection and in addition to this bacteriological examination, the blood must be examined to determine the presence or absence of a streptococcemia. The treatment must be based on scientific data, hence, it should conform with the result of what is found by culture from the throat and by the thorough examination of the blood.

If we can inject a sufficient quantity of antitoxin to stimulate cell activity and neutralize general toxæmia, then we give our patient the greatest opportunity to eliminate this deadly poison and to begin convalescence.

The ordinary shortcomings that are most frequently met with consist of placing too much reliance on the specific nature of antitoxin regardless of other vital necessities. In this infectious disease, where there is marked leucocytosis and other evidences of subnormal hæmic conditions, the indication next to antitoxin is for restorative treatment, especially nutrition.

Dry Antitoxin.—Dry antitoxin is a golden-yellow crystalline substance quite soluble in sterilized water.

Directions for Use.—The remedy must be dissolved immediately before use by adding from 1 to 4 cubic centimeters cold sterilized water by means of a sterilized pipette into a bottle of antitoxin. The solid serum dissolves slowly; the greatest caution must be used not to contaminate the solid serum, as it contains no antiseptic. Small vials containing 1000 units constitute a healing dose.[1]

It is then injected into the connective tissue of the intrascapular region, buttocks, thighs, or in the loose connective tissue of the abdomen or chest. A series of clinical results in severe and mild diphtheria was reported by me at the Section on Pediatrics of the American Medical Association, 1899. Very good results were noted.

The following case of diphtheria, complicated by laryngeal stenosis, will illustrate the mode of administration and its result:—

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[1] The firm of Victor Koechl & Co. are the importing agents of the dry antitoxin.

Lizzie G., born U. S.

Family History.—Negative; sister had diphtheria last year.

Habits and Surroundings.—Attends public school; tenement, two rooms; two adults, four children. Cleanliness leaves a great deal to be desired. Ventilation bad.

Previous History.—No contagious diseases. Inclined to tonsillar inflammations. Adenoids.

Present History.—The source of infection is probably to be sought in school or Sunday school. Lymphatic diathesis. The disease began on April 21st, when the child seemed feverish, restless, and complained of sore throat. A physician, who was consulted, declared that the child was suffering from "catarrh." The mother says she noticed some white spots in the child's throat. There was anorexia, cough and difficulty in swallowing. During the following night the cough assumed a croupy, brassy character, and in the morning the mother found that the child was breathing rapidly and noisily, and that the fever, sore throat, headache and nausea were intensified. There was considerable prostration. In the afternoon I saw the case, with Dr. Geo. A. Saxe. The child presented a considerable degree of laryngeal stenosis, so that we informed the mother that intubation would be necessary.

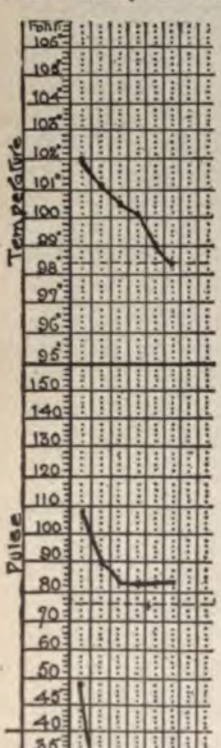

Fig. 176.—Temperature Chart from a Case of Diphtheria, Showing Effect of Dry Antitoxin. (Original.)

Examination.—An anæmic child, fairly well nourished, but with feeble musculature. The skin pale, hot and dry. There was no eruption. Herpes labialis. The bowels were regular; no vomiting. The temperature was 101° F., the pulse 108; the respiration 48, shallow and noisy. The intercostal spaces and the suprasternal notch and sternocostal angle are depressed at each inspiration. There is a croupy cough. The tongue is coated and moist. There is a slight nasal discharge. The conjunctivæ are normal. There are enlarged glands on both sides of the neck, which are hard, mobile, and not painful to the touch. The tonsils, arch of the palate, and posterior wall of the pharynx show the presence of yellowish-gray spots of false membrane. They are exceedingly difficult to dislodge. The surrounding mucosa is diffusely inflamed. A culture on serum agar was planted with some of the exudation, and within twenty-four hours sufficient growth appeared on the surface. The bacteriologist reported the presence of true Klebs-Loeffler bacilli. (Report New York Health Board, No. 2813.)

There was no pain in the chest, there was distinct bronchial fremitus on palpation. Auscultation was extremely difficult, on account of the laryngeal stenosis, and revealed sibilant and sonorous breathing, subcrepitant râles and pulmonary vocal resonance. Percussion sounds normal. The heart action regular, no murmur. The abdomen negative. The fæces are of normal color and consistency. The urine specific gravity 1022, no albumin, no casts, quantity average, reaction acid, color normal.

Diagnosis.——Tonsillar and laryngeal diphtheria.

Prognosis.—Grave, on account of the amount of laryngeal stenosis.

Treatment.—On the same day, an hour after the first visit, Dr. Saxe injected 1500 units of the dry antitoxin of Behring into the right hypochondriac region. Temperature at injection 102.4° F.; pulse 120; respiration 48. Calomel tablets, 0.015 t. i. d. Inunctions of 25 per cent. mercurial ointment to the neck. Semi-solid foods were ordered. At 8.30 P.M. on the same day I found the child suffering with severe laryngeal stenosis and *immediately intubated.* The relief was instantaneous.

April 23d. On the following morning the child's respiration was perfectly normal, being at the rate of 24 per minute. The temperature was 101.2° F., the pulse 90, and the general condition considerably improved. There was still considerable cough and stringy mucus was expectorated. The child was given a mixture containing 2 grains of ammonium carbonate, one drop of the tincture of strophanthus, 20 minims of syrup of wild cherry in a teaspoonful of water. The bowels were regular. The other medication was continued in the same way. No more antitoxin was given.

April 24th. The child's breathing is normal, and there is no sound of an obstruction, as there often is in intubated cases. The membranes disappeared from pharynx, tonsils, and palate. The examination of the heart and chest is negative. The herpes labialis and the swollen cervical glands are beginning to disappear. The temperature is 100.6° F., the pulse 84, and the respiration 24. The child sleeps well at night and has more appetite.

April 25th. The general condition is very good. The bacilli have disappeared from the throat, as attested by bacteriological examination. The temperature is 100.2° F., the respiration and pulse the same as on the preceding day.

April 26th. The child's cough is less frequent and the breathing is normal. The appetite is very good, the tongue clean, and the cervical glands almost normal. The same medication is continued. The temperature is 99° F., the pulse 84, and the respiration 24.

April 27th. The child was extubated (on the fifth day). The tube was coated with lime salts, but its lumen was free. There was no dyspnœa, and the child continued to breathe easily after the extubation. The temperature was 98.6° F.; the general condition very good.

In this case no sequelæ were observed, though on the day after the intubation the child developed symptoms resembling those of a broncho-pneumonia.

Dietetic Treatment.—As a tissue and blood builder *no medication equals food.* It is, therefore, imperative to support the general nutrition by proper feeding. Milk diluted with some cereal decoction, like oatmeal, barley or rice, will be better borne than pure milk alone. Buttermilk or zoolak may be given. Sometimes it is necessary to partially peptonize milk to render it more absorbable. If the child is old enough the yolk of a raw egg can be added to the milk (egg-nog). Concentrated beef broth, chicken broth, clam broth or oyster broth should be thought of. When feeding, once in three hours, it is a good plan to give some of this concentrated broth, followed in three hours by a milk feeding, and so alternate. In this manner we give our patient milk once in six hours. Acid fruits, such as oranges, lemons, grapes, and cranberries are very well borne. When acid fruits are ordered they should be given an hour before milk feeding. Older children can be given raw scraped steak, calf's-foot jelly, and ice cream which is nutritious and pleasant. When it is *difficult to feed by mouth* owing to excessive vomiting or to anorexia, or where intubation has been performed, it is a good plan to let the stomach have absolute rest and to depend on:—

Rectal Feeding.—No more than two ounces should be injected at one time.

Milk, predigested	1 ounce
Starch water	1 ounce
Laudanum	1 minim

To be injected slowly through a colon tube, after both colon and rectum have been cleansed by a soap-suds enema.

If the small nutritive enema is well retained we can repeat the injection once every four hours, and add the yolk of a raw egg to the above formula of milk, starch and opium. Next in importance to giving the proper dose of antitoxin is the nutrition of the body which has just been considered.

Elimination of Toxins.—The elimination of toxic elements can only take place by means of the bowels, kidneys, and skin. Normally in febrile conditions there is a general torpidity of the emunctories. Thus it is apparent that a dose of calómel, citrate of magnesia, or an alkaline solution like the milk of magnesia or a laxative mineral water, will aid in the performance of these functions.

Medicinal Treatment.—It is advisable to remove the putrid membranes from the nose and throat and also the catarrhal discharges. To do this, mechanical treatment consisting of the cleansing of the nose with a salt solution of the strength of one dram of table salt to one pint of water is useful. A weak (½ per cent.) solution of permanganate of potash can also be used to cleanse the nose with the aid of a syringe (see Fig. 210).

Septic products in the nose and throat will frequently lead to a fatal termination. Their presence is a constant menace to the blood by inviting toxæmia. In addition thereto they give rise to fever and not infrequently septic material will find its way from the nose and pharynx into the Eustachian tubes, causing abscesses. If neglected it may lead to mastoid involvement and brain abscesses or to septic meningitis, with *little or no chance of recovery.*

By observing the enlarged lymph glands, it is surprising to see what good result is apparent after cleansing the nose and pharynx.

Local Treatment of the Pseudo-membranes.—The solvent effect of local remedies I have never been able to see. When papayotin has been used, I have been disappointed in its effect. Creosote vapors, by adding a dram of beechwood creosote to a pint of water and allowing the air to become impregnated with the vapor has shown some good in a few instances. Lugol's solution of iodine (half strength) applied by means of absorbent cotton, can be recommended. A steam atomizer containing a weak solution of (2 per cent.) sulphurous acid is sometimes of value. The latter has been used by me and certainly can be recommended when there are extensive necrotic patches. It is far better than peroxide of hydrogen. Other local treatment which I have used with benefit is the inunction of unguentum Credé into the cervical glands, rubbed in at least fifteen to twenty minutes two or three times a day. An ice-bag worn continually can also be recommended when there is an extensive œdema.

Oxygen is indicated and required when there is the slightest evidence of cyanosis. It will also relieve dyspnœa when present. It is especially indicated during broncho-pneumonia, which so often complicates diphtheria.

Fever Treatment.—It is a wise plan to exclude antipyretic drugs during the treatment of fever in diphtheria. The best antipyretic measures consist in sponging with evaporating lotions such as alcohol and water or acetic ether, locally. Cold packs and flushing the bowel with cold water are very serviceable in some cases. When high fever, due to pneumonia, to nephritis or to any other complication exists, the same should be treated as though the disease existed independent of the diphtheria.

When fever exists and the child cries continuously then *the ears* should be examined. Frequently an otitis media will keep up high fever until the drum is ruptured. Ten to 20-drop doses of sweet spirits of niter are valuable if given several times a day. During the febrile stage of diphtheria calomel in $^1/_{10}$ to $^1/_2$-grain doses, repeated several times a day, is a useful adjuvant in fever treatment.

Stimulation.—Owing to the depressing effect of the diphtheritic poisons, stimulation should begin early. Strychnine, $^1/_{100}$ grain, for a child 1 year old, repeated three or four times a day, may be given. The dose can be gradually and cautiously increased until a systemic effect is noticeable. Children will tolerate very large doses of strychnine just as they will tolerate very large doses of whiskey. They can be combined. Tokay wine, champagne and coffee are valuable cardiac stimulants. Caffeine citrate and sparteine are also serviceable for enfeebled heart's action. The prognosis of a case of diphtheria is certainly better in a case where the heart has been supported until the toxæmia has passed away.

Paralysis.—The internal treatment of paralysis consists of strychnine and the usual restorative treatment. Galvanic and faradic electricity are good. Absolute rest in bed and gentle massage are indicated.

Statistics of the Kaiser and Kaiserin Friedrich Hospital in Berlin show a very interesting comparison between the mortality before and after antitoxin was used.

The death rate was 36.56, 35.57, and 45.78 in three successive years, or an average of 39.63 per cent. In the year 1894, when the serum treatment was first used, although experimentally, there were two interesting data: first, the mortality among cases treated with antitoxin was 16.6 per cent.; second, those treated without antitoxin, mortality 27.8 per cent.

In the following year (1895) all cases of diphtheria were injected with antitoxin; the mortality fell to 11.2 per cent.

Immunity.—Four hundred and sixty children were injected with the object of producing immunity. Of these only 18 came down with diphtheria. All of these cases were mild and not one died.

TABLE NO. 78.—*Diphtheria Cases—Willard Parker Hospital.*

TREATED WITHOUT ANTITOXIN.

Year.	No. Treated.	Died.	Mortality—Per Cent.	Recoveries—Per Cent.
1889	391	79	20.20	79.80
1890	311	67	21.54	78.46
1891	303	85	28.05	71.95
1892	311	79	25.40	74.60
1893	357	108	30.25	69.75
1894	732	205	28.01	71.99
Total.	2405	623	25.57	74.42

TREATED WITH ANTITOXIN.

Year.	No. Treated.	Died.	Mortality—Per Cent.	Recoveries—Per Cent.
1895	825	190	23.03	76.97
1896	860	205	23.84	76.16
1897	881	214	24.29	75.71
1898	612	109	17.81	82.19
1899	781	192	24.58	75.42
1900	823	238	28.92	71.08
1901	919	275	29.92	70.08
1902	1112	271	24.37	75.63
1903	1281	356	27.79	72.21
1904	1402	356	25.39	74.61
*1905	478	98	20.50	79.50
Total	10574	2504	23.67	76.33

*On account of rebuilding the Hospital, no patients were received after June 17th.

A comparative study of the deaths before antitoxin was used and the present method of treatment, where all cases receive antitoxin, can hardly be made. I frequently see septic cases sent to the hospital in a moribund condition. The city hospital is used as a dumping ground for all malignant cases, hence, the high mortality rate. The cases admitted belong to the laboring class of people. As these people are very poor, they delay sending for a physician until severe laryngeal stenosis sets in. When the disease has gained headway and there is a general septic condition, recovery, as a rule, is doubtful.

INTUBATION.

When laryngeal stenosis occurs during a case of diphtheria, then we must prepare for intubation.

The following symptoms demand intubation:—

Labored breathing.

A gradual and progressive dyspnœa.

A failing or intermittent pulse.

Cyanosis showing defective oxygenation.

Retraction of chest wall most marked at epigastrium or at the clavicles.

When the accessory muscles of respiration are brought into play.

When the child is compelled to sit upright in order to breathe and pulls at its neck and throws itself from side to side, gasping for breath.

Indications for Intubation.[1]—"The indications for intubation are marked by a more or less sinking in of the yielding portions of the chest, lower ribs and sternum, episternal notch, and supra-clavicular regions with inspiration. It means simply that air cannot gain entrance to the lungs in

TABLE NO. 79.—*Diphtheria Cases—Willard Parker Hospital.*

Year.	No. Treated.	Died.	Mortality Per cent	Recoveries Per cent.	Intubations.	Recoveries Inclusive.	Recoveries Per cent.
1901	919	275	29.92	70.08	222	70	31.53
1902	1112	271	24.37	75.63	258	116	44.92
1903	1281	356	27.79	72.21	352	123	34.91
1904	1402	356	25.39	74·61	410	193	47.
*1905	478	98	20.50	79.50	151	86	56.
Total	5192	1356	26.12	73.88	1396	588	42.13

*On account of rebuilding the Hospital, no patients were received after June 17th.

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[1] From O'Dwyer's treatise on "Intubation" in his book, "Diphtheria and Croup," 1889.

TABLE No. 80.—*Statistics of Intubation Cases, at the Willard Parker Hospital.*

1901				1902.			
Month.	Discharged.	Died.	Per cent. Recoveries	Month.	Discharged.	Died.	Per cent Recoveries
Jan.	2	15	11.76	Jan.	11	10	52.38
Feb.	2	11	15 38	Feb.	10	10	50.00
March	8	17	32.00	March	12	20	37.50
April	6	15	28.57	April	18	28	39.13
May	7	13	35.00	May	4	14	22.22
June	4	10	28.57	June	17	10	62.96
July	2	10	16.67	July	1	9	10.00
Aug.	5	12	29.41	Aug.	5	8	38.46
Sept.	4	13	23.52	Sept.	8	7	53.33
Oct.	8	9	47 05	Oct.	6	3	66.67
Nov.	9	13	40.90	Nov.	9	11	45.60
Dec.	7	20	25.92	Dec.	13	14	48.15
Total	66	158	334.75	Total. . .	114	144	525.80
General Average of Recoveries for 1901, 27.89.				General Average of Recoveries for 1902, 43.81.			
Improvement in 1902 over 1901, 15.92 per cent.							

sufficient quantity to fill the partial vacuum created by the expansion of the chest, and the wall recedes under the weight of the atmosphere. It is very marked in very young or rachitic children owing to the greater elasticity of the ribs. But it should be remembered that this condition is not peculiar to stenosis of the larynx and trachea, as it is produced to a lesser degree by obstruction in any part of the respiratory tract that interferes with the free inflation of the lungs. It is found in capillary bronchitis, extensive deposits of pseudo-membrane in the bronchi, atelectasis, and to some extent even in broncho-pneumonia. Recessions at the root of the neck are more significant than those below, as the violent contractions of the diaphragm aid in drawing in the free border of the ribs and sternum.

"When recessions are marked there is little or no respiratory murmur over the posterior portion of the chest, but this symptom is not always available owing to the laryngeal stridor.

"Atelectasis with excessive quantity of blood in the lungs, as would naturally be expected, is the result of death from obstruction in the larynx, but there are exceptions to this rule, and these organs are occasionally found distended with air and containing less than the normal amount of blood. This acute general emphysema, which produces bulging of the parts that usually recede, is caused by greater impediment to expiration than inspiration, and air accumulates in the lungs in the same manner

Table No 81.—*The Following Table Shows the Results from Intubation in Cases of Laryngeal Diphtheria Treated at the Municipal Hospital, Philadelphia, from 1894, to 1903, Inclusive.*

Year.		Intubated Cases.	Deaths.	Mortality Per Cent.
1894	Without antitoxin	100	75	75.00
1895	About 50 per cent. received antitoxin . .	122[1]	67	54.91
1896	With antitoxin	156[2]	94	60.25
1897	" "	182	127	69.78
1898	" "	149	104	69.99
1899	" "	165	97	58.78
1900	" "	202	111	54.95
1901	" "	139	66	47.47
1902	" "	110	54	49.09
1903	" "	110	55	50.00
Total	. . . .	1435	850	59.23

[1] Of those who received antitoxin the death rate was 52.94 per cent.
[2] 24 per cent. of this number did not receive antitoxin.

as in spasmodic asthma. It is not common in croup, but is worth remembering. It is also occasionally found in capillary bronchitis.

"The downward movement of the larynx with inspiration is pathogenic of serious obstruction in this organ, and is also the result of atmospheric pressure, the air being prevented from entering with sufficient rapidity to fill the partial vaccuum below. It is readily detected in adults, but not so in children, owing to deeper situation of the larynx in the latter.

"This symptom is not present in stenosis of the trachea, owing to the great elasticity of this tube, which permits of considerable motion on itself without displacing the larynx.

"Abiding cyanosis is too late a symptom to wait for, and besides, it is uncertain, as fatal obstruction may exist in the glottis with extreme pallor on the surface. This pallor of asphyxia is produced by the excessive quantity of blood drawn into and stored in the lungs by the cupping-glass action of inspiration when the air is almost excluded. The blood in the cutaneous capillaries is thus reduced to a minimum, and this, although highly charged with carbonic acid, only serves to increase the paleness, on the principle that the addition of a little blue makes a clearer white.

TABLE No. 82.—*The Following Table Shows the Cases and Mortality of Diphtheria (Including Membranous Croup) in the Municipal Hospital,*[1] *Philadelphia, from 1890 to 1903, Inclusive.*

PRE-ANTITOXIN PERIOD.

Year.	Cases.	Deaths.	Mortality—Per Cent.
1890	12	3	25.00
1891	29	1	3.44
1892	183	48	26.22
1893	217	62	28.57
1894	465	154	33.12
Total	906	268	29.58

ANTITOXIN PERIOD.

Year.	Cases.	Deaths.	Mortality—Per Cent.
1895	706	190	26.91
1896	869	193	22.2
1897	1295	300	23.16
1898	1229	297	24.16
1899	1373	275	20.02
1900	1299	264	20.31
1901	889	174	19.57
1902	601	137	22.79
1903	746	170	22.78
Total	9007	2000	22.2

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[1] I am indebted to Dr. Welch for above statistics.

Table No. 83.—*Cases of Diphtheria Treated at the Boston City Hospital.*[1]

CASES TREATED WITHOUT ANTITOXIN.

Year.		No. Treated.	Died.	Mortality Per cent.	Recoveries Per cent.	Intubations.	Recoveries Per cent.
Calendar Years	1889	529	239	45.17	54.82	128	18.75
	1890	415	151	36.38	63.61	93	15.05
Financial Years	1891-2[2]	237	105	44 30	55.69	50	16.00
	1892-3	387	185	47.80	52.19	65	13.84
	1893-4	419	203	48.44	51.55	109	17.43
	1894-5	698	266	38.10	61.89	89	16.85
	Feb. 1 to Sept. 1 1895	611[3]	111	18.16	81.83	39	28.20
	Total	3296	1260	38.22	61.77	573	17.45

CASES TREATED WITH ANTITOXIN.

Year.		No. Treated.	Died.	Mortality Per cent.	Recoveries Per cent.	Intubations.	Recoveries Per cent.
Financial Years	Sept. 1 to Jan. 31 1895–6[4]	844	96	11.37	88.62	79	54.43
	1896-7	1889	276	14.61	85.38	224	35.26
	1897-8	1387	181	13.04	86.95	146	54.11
Calendar Years	1898	817	97	11.87	88.12	171	40.84
	1899	1621	162	9.99	90.00	192	67.18
	1900	2547	293	11.50	88.49	259	66.40
	1901	1576	185	11.73	88.26	184	68.47
	1902	1008	111	10.20	89.79	145	66.20
	1903	1179	138	11.70	88.29	139	73.38
	Total	12868	1539	11.95	88.04	1439	59.54

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[1] I am indebted to Dr. McCollum for above statistics

[2] Thirteen months included in year 1891-2.

[3] Some of these patients received antitoxin, but how many it is impossible to say. This explains the comparatively low death-rate from Feb. 1, 1895 to Sept. 1, 1895

[4] From Sept. 1, 1895, at which time the South Department was opened, to Dec. 31, 1903, every patient ill with diphtheria received antitoxin.

"The temporary cyanosis which comes and goes with the paroxysmal dyspnœa of the second stage of croup is of no particular significance. *Children seldom remain long in one position when suffering severely from want of breath, and continued restlessness, if consciousness be unimpaired, is therefore an important indication that it is time to afford relief.*

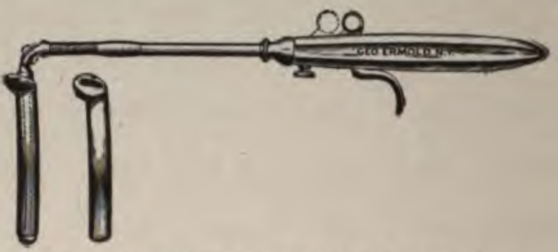

Fig. 177.—Introducer with Tube Attached.

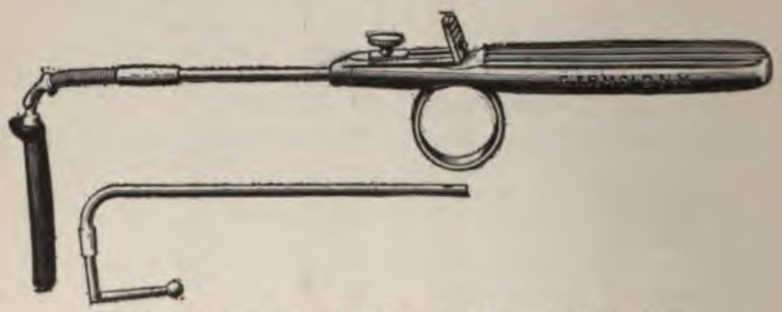

Fig. 178.—Introducer with Tube and Detached Obturator.

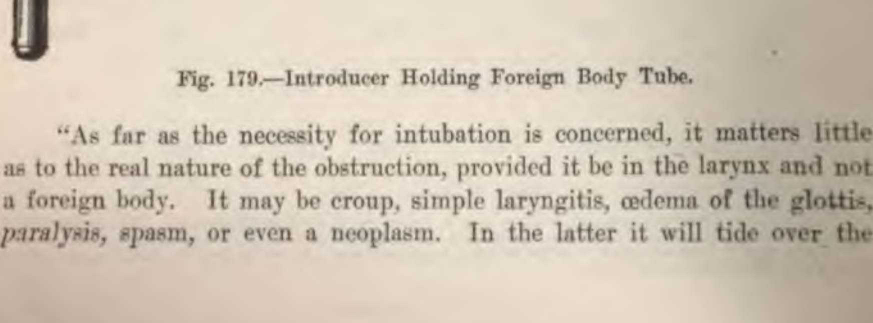

Fig. 179.—Introducer Holding Foreign Body Tube.

"As far as the necessity for intubation is concerned, it matters little as to the real nature of the obstruction, provided it be in the larynx and not a foreign body. It may be croup, simple laryngitis, œdema of the glottis, *paralysis*, spasm, or even a neoplasm. In the latter it will tide over the

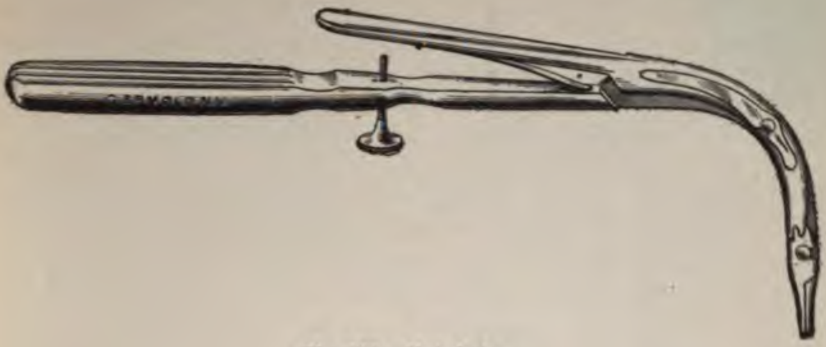

Fig. 180.—Extubator.

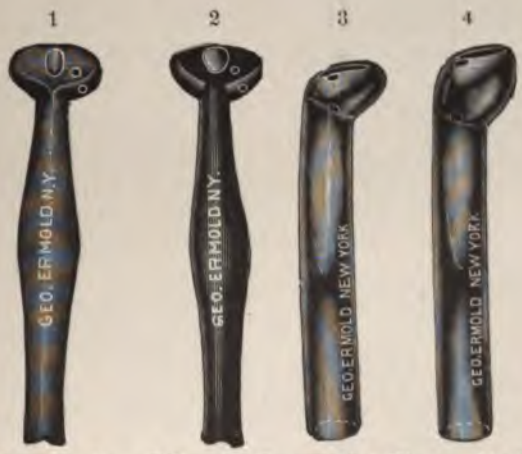

Fig. 181.—Built up Tubes for Granulation Tissue. Useful for treatment of "Retained Tubes."

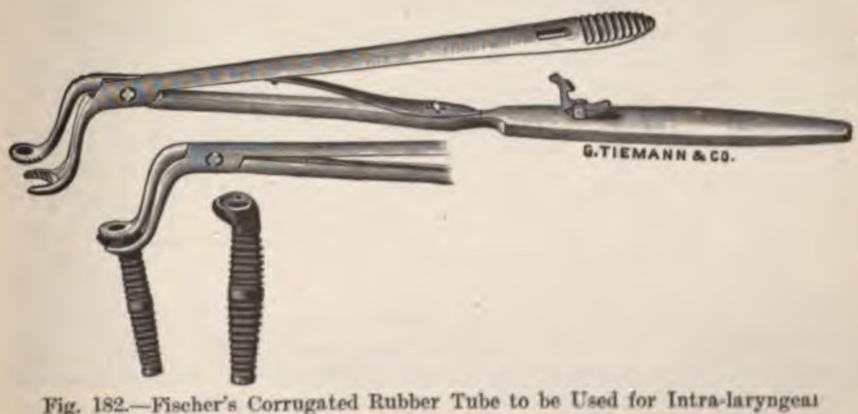

Fig. 182.—Fischer's Corrugated Rubber Tube to be Used for Intra-laryngeal Medication in Chronic Stenosis (Recurring Stenosis).

immediate danger of asphyxia, and leave more breathing room to facilitate the radical operation."

Dorsal Method of Intubation.—This method is the most convenient as it does away with the necessity of several assistants. I have frequently intubated in the dorsal position without any assistant. This method appeals to me as very valuable in emergencies, especially so when a physician is called out of town where no trained assistant is available. The method of introducing the tube is the same as that described as the O'Dwyer method. The dorsal method has been advocated by the attending and resident staff at the Willard Parker Hospital and is the method employed there by Dr. Burckhalter, Dr. Lynah, and Dr. Throne.

The gag should be inserted in the left side of the mouth, and slowly opened. The trained nurse steadies the child's head and holds the gag in place. With the child flat on its back, the hands firmly held by a blanket encircling the body, the physician stands on the right side of the child and introduces the index finger of his left hand in the median line until the epiglottis is felt. The epiglottis should be raised and fixed. The tube should then be guided with the right hand of the operator, along the left index finger and inserted into the cul-de-sac of the larynx. It would be profitable to read O'Dwyer's description of the method of intubation which I append here, the only difference being that O'Dwyer recommends the sitting position, whereas I advocate the dorsal position.

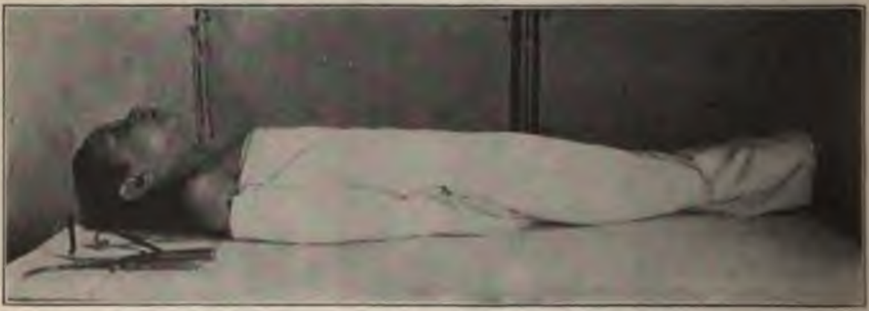

Fig. 183.[1]—The Mummy Bandage, showing child in proper position for the dorsal method of Intubation. All instruments required are carefully arranged. (Original.)

Upright Method of Operating.—"The nurse or person who holds the

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[1] The set of photographs illustrating Intubation, Extubation, and Gavage were taken in the wards of the Willard Parker Hospital. I am indebted to Miss Henry, the supervising nurse, Miss Dunwoodie, the head nurse, and Dr. T. De L. Burckhalter and Dr. Lynah, the resident and assistant resident physicians, for their uniform courtesy and kind assistance with my illustrations and clinical details.

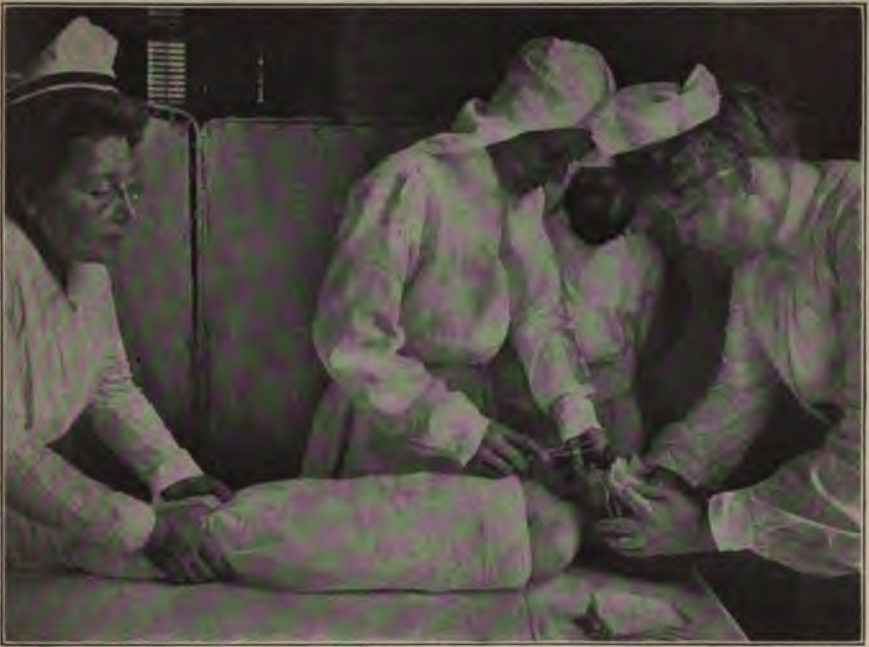

Fig. 184.—Intubation. First step in operation: The handle of introducer parallel to the body axis; the top of the tube just entering the larynx. (Original.)

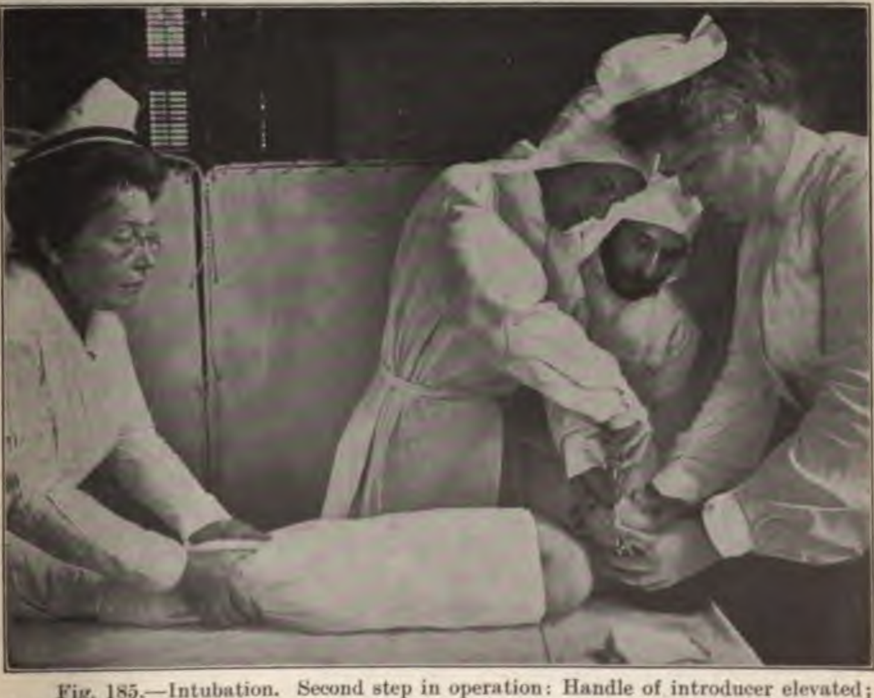

Fig. 185.—Intubation. Second step in operation: Handle of introducer elevated; the tube sinking into larynx as the handle of introducer is elevated. (Original).

child should be seated on a solid chair with a low back, and the patient placed on the lap with head resting on left shoulder of nurse in order to leave the gag free. The hands can either be held or, still better, secured by the sides, by a towel or sheet passed around the body and left in that position until the tube is inserted and the string removed. Fastening the hands in front of the chest or thick garments in the same location renders it more difficult to depress the handle of the introducer sufficiently to carry the tube over the dorsum of the tongue.

"The gag is then inserted well back behind or between the teeth in the left angle of the mouth and opened widely, care being taken not to do it too suddenly or to use too much force. In children who have not at least one bicuspid on the left side, the gag should not be used, as it slips forward on the gums, and, besides being in the way, is liable to injure the incisor teeth. There is little difficulty in these cases in keeping the mouth sufficiently open with the finger, if carried far enough to the patient's right to be out of range of the front teeth. Allowing the child to compress the finger between the gums for a few seconds until the jaws relax, before carrying it into the fauces, avoids the necessity for using force.

"An assistant stands behind the patient and holds the head firmly by placing one hand on either side, and at the same time slightly elevates the chin. The operator stands in front of the patient, holding the introducer lightly between the thumb and fingers of the right hand, the thumb resting on the upper surface of the handle, just behind the knob that serves to detach the tube, and the index finger in front of the trigger support underneath. Held in this manner it is impossible to use force enough to make a false passage, while if firmly grasped in the hand the beginner may, unconsciously, exert sufficient force to lacerate the tissues.

"The index finger of the left hand is carried well down in the pharynx or beginning of œsophagus and then brought forward in the median line, raising and fixing the epiglottis, while the tube is guided along beside it into the larynx. If any difficulty is experienced in locating the epiglottis, it is better to search for the cavity of the larynx, a cul-de-sac into which the tip of the finger readily enters, and which cannot be mistaken for anything else. Once in this cavity the epiglottis must be in front of the finger and the latter is then raised and pressed toward the patient's right to leave room for the tube to pass beside it. The distal extremity of the tube should be kept in contact with the finger, and even directing it a little obliquely toward the right side of the larynx if necessary to get inside the left aryepiglottic fold, especially in very young children. The handle of the introducer is held close to the patient's chest in the beginning of the operation, and rapidly raised as soon as the end of the tube has passed behind the epiglottis, otherwise it will slip over the larynx into the œsophagus.

"Some operators hold the introducing instrument in the horizontal

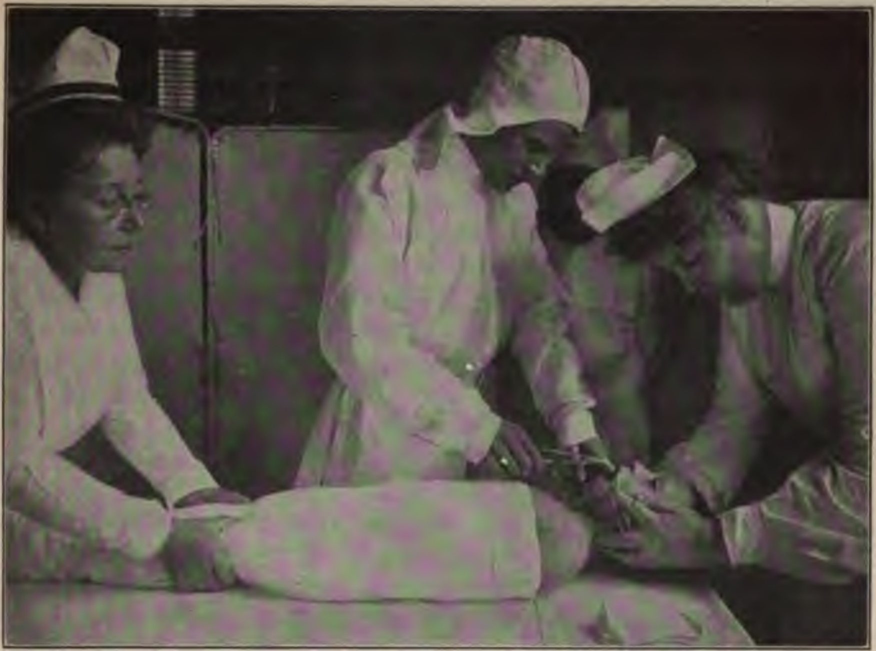

Fig. 186.—Extubation. First step in operation: The gag in position. The extractor is guided along the left index finger until the beak enters the lumen of the tube. (Original.)

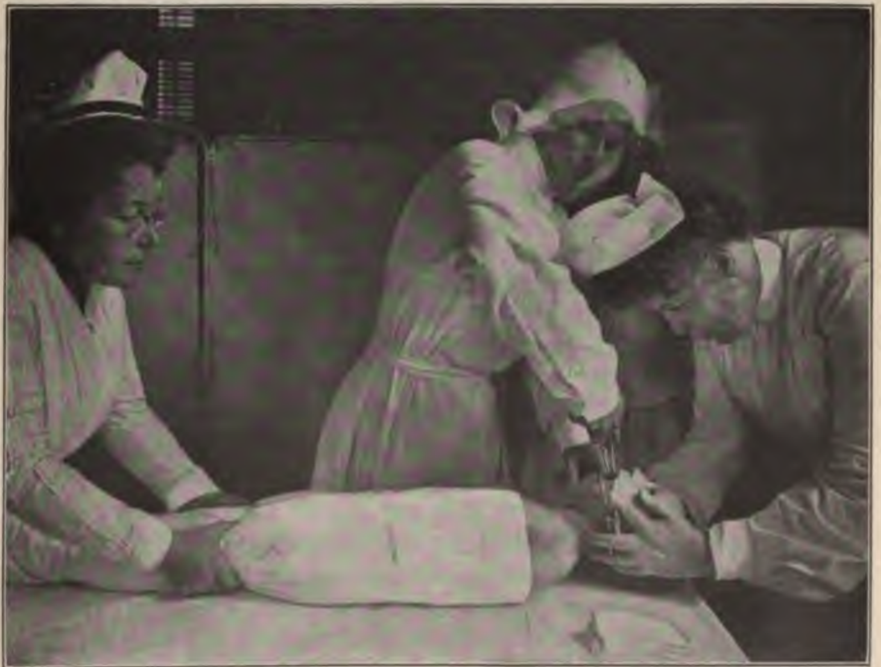

Fig. 187.—Extubation. Second step in the operation: The beak of the extractor holding the tube firmly; the operator withdraws the tube. (Original.)

position until the tube is well back in the fauces, and then swing it around to the middle line and complete the operation in the usual manner. The beginner is liable to forget the latter movement, which is the only objection to this plan.

"As soon as the cannula is inserted the introducer with obturator attached is withdrawn by pressing forward the button on the upper surface of the handle with the thumb, while counter-pressure is made with the index finger on the trigger beneath. In removing the obturator—the joint in the shank of which is intended to facilitate this part of the operation—the movements required for insertion are reversed. To prevent the tube from being also withdrawn, the finger must be kept in contact with its shoulder either on the side or posteriorly.

"The tube should be carried well down in the larynx before detaching it, otherwise the lower aperture will be left open and liable to strip off pseudo-membrane as it is subsequently pushed home with the finger.

"The gag is removed as soon as the tube is in place, but the string is allowed to remain in place long enough to be certain that the dyspnœa is relieved and that no loose membrane exists in the lower portion of the trachea. In some cases the presence of the thread is desirable because it excites more coughing, which is necessary to expel accumulated secretions and to inflate any collapse of the lungs that may have taken place. In removing the string the finger must be reinserted to hold the tube down, but the gag is rarely necessary, as children old enough to understand readily open the mouth for this purpose."

The characteristic tubal cough due to a rush of air through the tube when in the larynx, if once heard will always be remembered. Usually the presence of the tube excites a paroxysm of coughing and large quantities of mucus and membrane will frequently be expelled. The effect most noticeable is the immediate relief of the laryngeal stenosis. It is wise to wait five or ten minutes before withdrawing the silk thread that has been placed in the tube. After cutting the thread the finger should again be placed over the head of the tube, and the tube firmly pressed down while the string is withdrawn.

There are several important points which must be emphasized in this operation. In the first place no force is necessary. "Occasionally a momentary spasm retards the immediate entry of the tube into the larynx, in which case rather than use force, it is best to wait a second or two for this to relax, when the tube will fall into place. The introducer should be held lightly between the end of the thumb and finger, and not grasped firmly in the hand. The introducer should be kept exactly in the middle line, otherwise the obturator will pinch in the caliber of the tube and drag the latter with it as it is withdrawn. It often happens that the child manages by one *effort to slip* down in the nurse's lap, while the grasp that the assistant exerts tilts the head back, and the tube may impinge on the posterior wall of the larynx. The lines and angles must be maintained to insure quick intubation. The lack of observance and of carelessness in these points explain many failures of inexperienced operators. *If the tube is not properly placed at the first attempt, it is better to begin all over, making repeated short attempts, if necessary, rather than a single prolonged one.*"

Accidents During Intubation.—An inexperienced operator will frequently be rewarded by fatal asphyxia. Prolonged attempts to introduce the tube will result in apnœa.

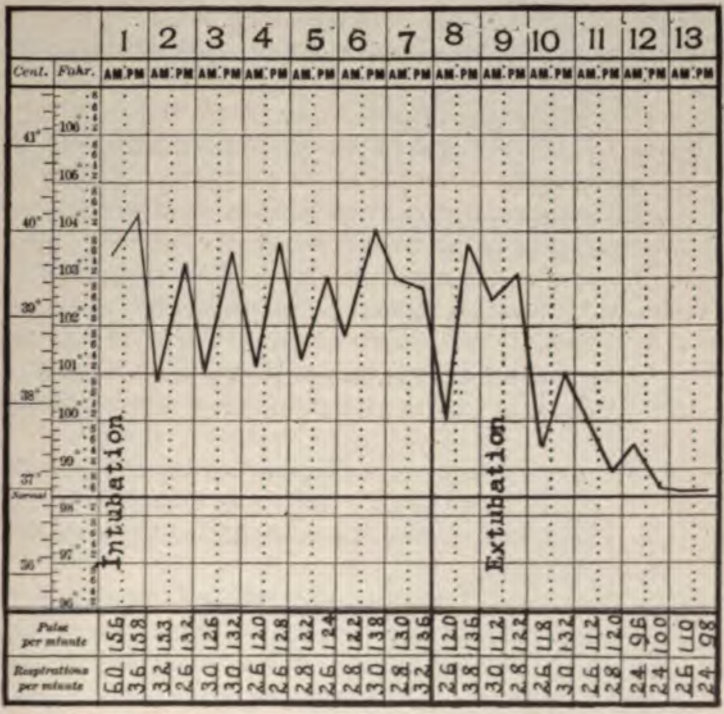

Fig. 188.—Baby K., nursing infant, eleven months old, suffered with Laryngeal Diphtheria complicated by Broncho-pneumonia. Stenosis requiring intubation. Case seen in consultation with Dr. Kahrs in Bronx. Tube remained in larynx nine days. Child recovered. Private practice case. (Original.)

"Ten seconds is the longest time that should be occupied in each attempt, if the child is suffering from urgent dyspnœa at the time." A child cannot breathe while the finger is in the throat. Repeated attempts will so exhaust the vitality of a child that this must be reckoned with.

"The expert seldom requires more than five seconds to complete the operation, except in difficult cases, such as a very small mouth and throat, marked increase in the size of the tonsils, especially if chronic; extreme tumefaction of the epiglottis and aryepiglottic fold, which changes or obliterates the usual landmarks, and the struggles and resistance sometimes offered by older children when intractable. In the latter, although I have never had to resort to it, the *administration of an anæsthetic would be less injurious* than the exhaustion and cyanosis induced by a prolonged struggle without it.

"If the tube has once passed on the outside of the larynx, and this is recognized before it is detached from the obdurator, it is useless to try to rectify the position without first depressing the handle of the introducer as in the beginning of the operation, because, owing to the length of the tube, the palate arrests the upward movement before the distal extremity reaches the level of the glottic opening.

"In croup the ventricles of the larynx are usually obliterated by swelling of the tissues and covered over by the pseudo-membrane, and therefore seldom offer any obstacle to the passage of the tube on the first introduction; but when the stenosis persists longer than usual and reintroduction becomes necessary, it is well to remember that this may be a source of obstruction. The tube once having entered a ventricle, a moderate amount of force is all that is necessary to make a false passage. I have known this accident to occur when the operator was unconscious of having used any force whatever. If the patient's head be thrown too far back, the tube may also be arrested by coming in contact with the anterior wall of the larynx or trachea."

An accident, which fortunately is very rare, is the pushing of membrane downward. In this condition stenosis will not be relieved. In such cases it is advisable to extubate at once, and to reintubate by using one of the specially constructed tubes.

Specially Constructed Tubes (see Fig. 181).—*Caliber tubes,* made of metal, also known as *foreign body tubes,* have a much wider lumen than the ordinary tubes used for intubation. They are also shorter. Through these tubes large membranes are frequently expelled. There are instances, however, where large pseudo-membranes extend into the trachea to the smallest ramifications of the bronchi. Violent coughing paroxysms frequently dislodge these membranes, so that *distinct casts of the trachea* and its bifurcation can be plainly made out. Several of these casts were seen by me during my service at the Willard Parker Hospital.

Intubation in Chronic Stenosis of the Larynx.—O'Dwyer's rules and indications for the performance of intubation in chronic laryngeal stenosis, are as follows: (1) Cicatricial stenosis, due to injury to the soft parts from syphilis, irritants, and traumatism. (2) Narrowing of the space both below and above the vocal bands from the products of chronic inflammation—simple, tuberculous, specific, malignant, or otherwise, and including such conditions as the so-called pachydermia laryngis, and corditis vocalis inferior hypertrophica. (3) It is especially valuable in cases in which tracheotomy has been performed, and, when the tracheal cannula having been worn for a considerable length of time, the upper part of the trachea is filled with granulations and the laryngeal muscles have become weakened from disease. In this condition intubation has effected many brilliant cures. (4) In papilloma of the larynx it has been found helpful in a fair proportion of cases, although its results in this disease are less satisfactory than in most others in which it has been employed. (5) Deformities of the larynx from injury or disease of its cartilaginous framework, which have resulted in constriction of the caliber of the organ, have been cured by it. (6) It has also been used, with excellent results, in anchylosis of the crico-arytenoid articulations, and in arthritis deformans of the same part. (7) It is useful in various affections of the nerves of the larynx; for instance, in hysterical contraction of the abductors, "aphonia spastica."

Edwin Rosenthal[1] advises a spray of peroxide of hydrogen as a preliminary to intubation. Rosenthal does not believe that heart failure, which is in reality toxæmia, can be cured. He insists on cardiac stimulants and gives strychnine from the beginning, in increasing doses.

In a paper published by W. L. Stowell, the following statistics occur: MacNaughton and Maddern reported 5506 intubation cases, with 30 per cent. of recoveries. Dillon Brown reported 276 intubation cases, with calomel fumigations, and 49 per cent. of recoveries. The collective investigation of the American Pediatric Society now places the mortality of laryngeal diphtheria, or croup, at 21 per cent.; and in intubated cases with antitoxin at 27.24 per cent.

The Tolerance of the Larynx for the Intubation Tube.—I have frequently seen children walking around the wards of the Willard Parker Hospital who have worn intubation tubes about two years. When one considers the anatomical structure of the larynx, it is surprising that no inflammatory condition results from the presence of this foreign body. In the chapter on "Broncho-pneumonia" I report a case of diphtheria complicated by croup and later by broncho-pneumonia. Intubation was required for the relief of laryngeal stenosis. The child coughed violently and expelled the tube so frequently that the case had in all *twenty intubations.* The case finally recovered.

Ulcerations due to the intubation tube have been seen by me:—

(1) In the cricoid division of the larynx, just below the vocal cords.

(2) At the base of the epiglottis, from pressure during the act of swallowing.

(3) On the anterior wall of the trachea near the distal end of the tube.

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[1] Archives of Pediatrics, June, 1903.

Ulcerations resulting from an intubation tube have been seen by me post-mortem in children that were fed by gavage. I have also seen ulceration where children were fed by the natural methods. I believe that feeding with the swallowing movements incidental to the same produces ulceration at the lower end of the tube, because of the up and down riding of the tube.

A post-mortem specimen of larynx and trachea was recently (October, 1904) examined by me at the Willard Parker Hospital. The child was in the hospital twenty-one days, it was therefore an acute laryngeal stenosis. Three ulcerations existed at the cricoid cartilage and nine other ulcerations existed at the distal end of the tube.

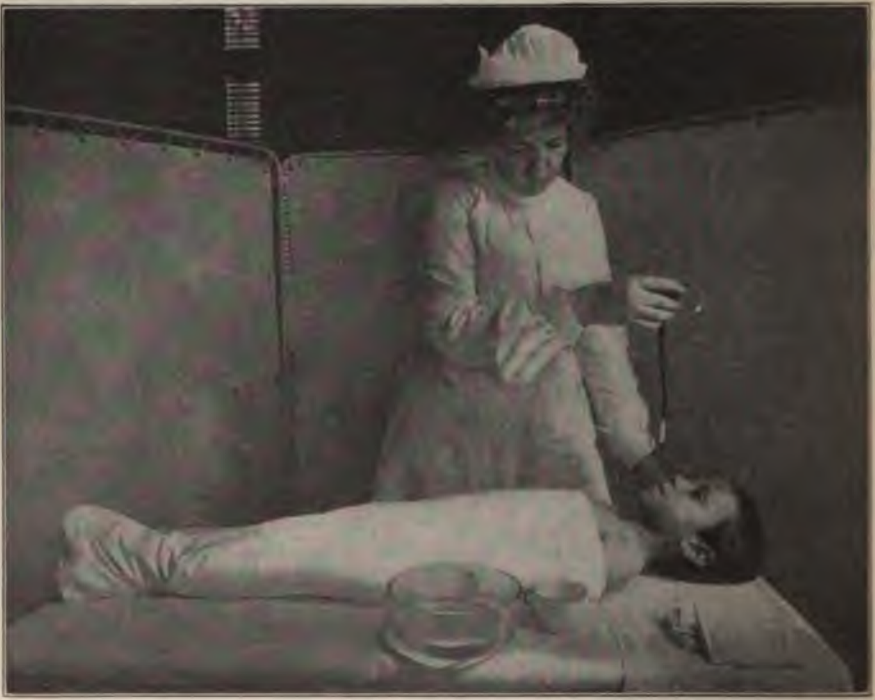

Fig. 189.—Gavage. Method used in Forced Feeding at the Willard Parker Hospital. (Original.)

Feeding After Intubation.—Various methods of feeding are in vogue, and each clinical observer seems to be satisfied with his particular method. Whenever possible we should try to resort to the usual mouth feeding. I invariably feed semi-solid food, such as bread soaked in milk, custard, junket, cornstarch, or rice pudding, soft boiled eggs, if the child's age warrants it; also concentrated soups and broths, calfsfoot or chicken-jelly, water ices and ice cream. These articles of food I have found best adapted in a very extensive experience in hospital and consultation practice.

In very young infants, breast or bottle-fed, great care should be exercised with the feeding. If a breast-fed child refuses to nurse, the breast-milk can be pumped off and the infant fed every three or four hours by spoon.

My advice in intubated cases: Use natural methods of feeding—do not use gavage—choose simple ways. Rectal feeding may be tried if vomiting occurs.

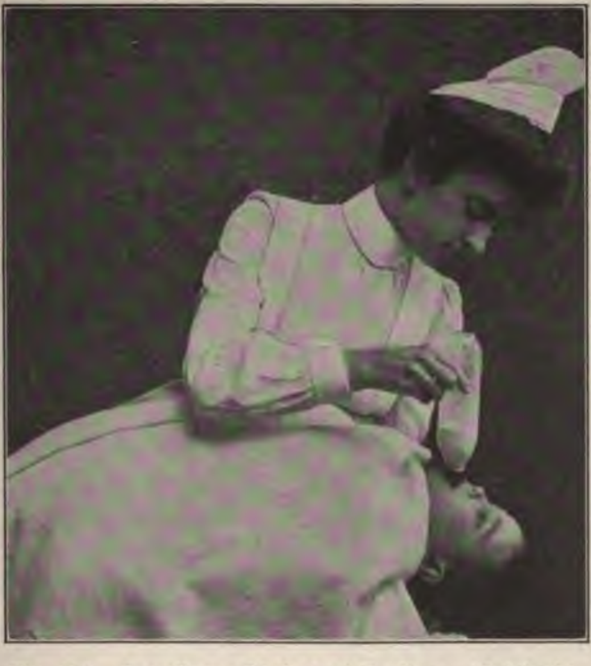

Fig. 190.—Casselberry Method of Feeding. (Original.)

The Casselberry method of feeding consists in laying the child flat on its back across the nurse's lap, with the head below the level of the body. By this means we avoid introducing liquids into the larynx.

INTUBATION IN PRIVATE PRACTICE.

The management of a case of intubation in private practice should be carefully considered. No child should be permitted to wear a tube in the larynx without the constant supervision of a trained nurse. In the Willard Parker Hospital we have competent trained nurses both night and day, and a physician is always ready to respond in case of emergency. I have frequently intubated in private practice and always give the following orders to the trained nurse:—

First.—If the breathing becomes labored or if the child has a sudden increase in the number of respirations, notify the physician at once.

Second.—Watch the pulse; a sudden increase in the pulse-rate or a sudden intermittent pulse means danger.

Third.—If cyanosis or sudden apnœa occurs, possibly caused by a plugging of the lower portion of the tube with membrane, notify the physician so that the tube can be extubated and a tube of larger caliber inserted.

Fourth.—If the tube is suddenly expelled during a paroxysm of coughing (auto-extubation), a hurry call should be sent to the physician.

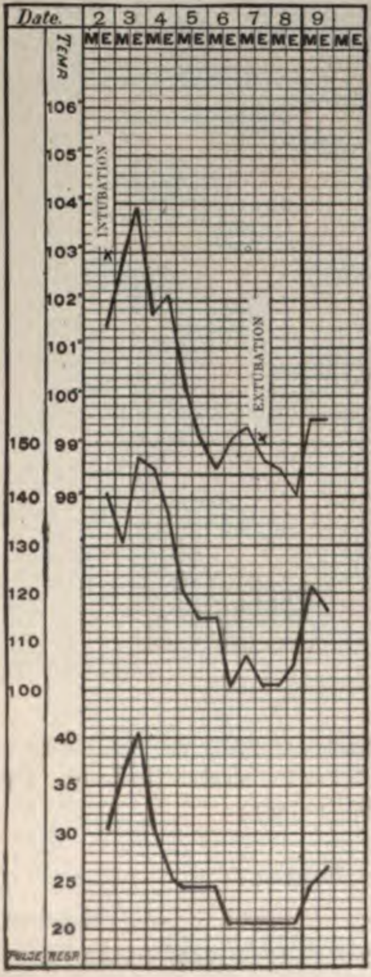

Fig. 191.—Temperature Chart from a Case of Diphtheria: Croup, Intubation. (Original.)

What to Do in an Emergency. *First.*—Give a mustard foot-bath or apply a mustard plaster over the heart to stimulate the circulation.

Second.—Give 5 to 10 drops of aromatic spirits of ammonia with an equal quantity of whisky. Nitroglycerine can be given in $^1/_{100}$-grain doses every hour, hypodermically if necessary.

Third.—Relieve the stenosis, if it exists, by careful intubation.

Fourth.—If an expert intubator is not at hand, or if intubation pushes membrane downward so that the stenosis persists, *resort to tracheotomy.*

Regarding extubation, my rule in private practice is to extubate on the fifth day, or on the morning of the sixth day, provided the temperature is normal and no complication exists. *It is safer to leave a tube in the larynx one day longer rather than risk the necessity of reintubation.*

Mamie B., 2 years old, was seen by me through the courtesy of the attending physician, Dr. H. Weinstein, on the second day of her illness. There were patches of diphtheria visible on the pharynx and tonsils. The temperature was 101 $^{2}/_{5}$° F., pulse 140. There was also laryngeal involvement noticeable by the croupy cough. An injection of 2000 units of antitoxin was first given. The colon was flushed and the bowels thoroughly emptied. A dose of calomel was given and milk and albumin water ordered, for the diet.

Nasal irrigations of saline solution were ordered every two hours. An ice-bag was applied to the neck. On the third day the temperature rose to 102° F., pulse 130, respiration 36. Breathing labored—considerable retraction of the chest—cough very croupy. Large quantities of mucus were expectorated. The pulse was 146, respiration 40. Stimulation was demanded and 1 drachm of whisky was given every hour. Laryngeal stenosis was so severe that a hurry call was sent to me to intubate. The child was quickly intubated. A No. 3 rubber tube having a coating of gelatine and alum was inserted. The stenosis was immediately relieved. The child appeared comfortable and fell asleep. Six hours after the intubation the temperature was 103° F., pulse 140, respiration 40. Cold sponging was ordered and owing to severe coughing when liquids were given, semi-solids were ordered while the intubation tube was *in situ*. On the following day the temperature dropped to 101.6° F., and on the third day after intubation the child was practically normal. The tube was left in the larynx five days, and as soon as the temperature dropped to 99° F. the child was extubated. The patient made an uneventful recovery. No complications followed. I might add that the usual rule of administering 15 grains of bromide of sodium or $^{1}/_{12}$ grain of sulphate of morphine, as an anti-spasmodic one hour before extubation, was not given in this case.

A Study of the Condition of the Upper Air Passages Before and After Intubation of the Larynx. Also, an Inquiry Into the Method of Feeding Employed in the Cases.[1]

Laryngeal stenosis will frequently be relieved after one intubation and one extubation. There are other cases which require several intubations before a permanent cure results.

I have examined a series of children that were operated upon several years ago. Two classes of cases have been selected. One series was seen at the Willard Parker Hospital, and the cases were intubated by the resident or assistant resident physician. The cases in this series cover the years 1896 to 1900, and were under treatment of Dr. E. G. Bryant and Dr. Somerset.

First Series. Children Intubated in the Hospital.—The children admitted to the Willard Parker Hospital belong, as a rule, to the laboring class of people. Exceptionally, the service at the hospital receives patients of a better class. All of the children examined by me belonged to the tenement house district of New York City. The houses are densely crowded tenements having a minimum quantity of fresh air and sunlight. It is not unusual to see cases from such unsanitary surroundings ending fatally. These children are, as a rule, very anæmic and are extremely susceptible to infection.

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[1] Paper read before the International Medical Congress held at Madrid, Spain, April 26, 1903.

TABLE No. 84.—*Series of Hospital Cases.*

No.	Name.	Sex.	Time of Patient in Hospital.	Kind of Feeding.	Age.	No. of Antitoxin Units Used.	When Intubated.	No. of Intubations.	Recent Examination at the age of	Condition of Throat.	Condition of Chest.	General Condition.
1	Celia M.	F.	30 days	All Breast-fed.	3 yrs.	6000 units N.Y. Dept. of Health	2d day of illness	1	10 yrs.	Enlarged Tonsils, Chronic Pharyngitis	Slightly pigeon-breasted	Rachitic, anæmic.
2	Ida S.	F.	44 "		4 "	2000 units N.Y. Dept. of Health	4th day of illness	1	7 "	Enlarged Tonsils, Pharyngitis	Rachitic, Harrison's groove, beaded ribs, funnel-shaped depression, pigeon-breast	
3	Nathan L.	M.	26 "		3 "	3000 units N.Y. Dept. of Health	2d day of illness	1	6 "	Rhinopharyngitis	Slight rachitis	General condition fair. Subject to dyspnœic attacks. Following year had measles and croup. Influenza and bronchitis lately.
4	Albert R.	M.	15 "		3 "	2000 units N.Y. Dept. of Health	2d day of illness	1	6 "	Enlarged Tonsils, Adenoids, Pharyngitis	Rachitis	Lymph nodes enlarged. Otitis, left ear. Rachitis. Measles and bronchitis after discharge.
5	Abie A.	M.	37 "		2 "	2000 units N.Y. Dept. of Health	3d day of illness	1	5 "	Tonsillitis hypertrophica, Rhinopharyngitis	Harrison's groove, beaded ribs	General condition fairly good. Measles shortly after convalescence. Mild attack of croup two years later. Dyspnœa at times, due to catarrh.
6	Hugh L.	M.	17 "		5 "	2000 units N.Y. Dept. of Health	9th day of illness	1	8 "	Enlarged tonsils, Pharyngitis	Chest well developed	General condition good. Has an occasional cough.
7	Sammy S.	M.	18 "		6 "	2500 units N.Y. Dept. of Health	5th day of illness	1	12 "	Enlarged tonsils, Pharyngitis	Excellent, no rickets	General condition good. Well nourished boy. Mild throat symptoms. Is subject to colds.
8	Patrick R.	M.	19 "		4 "	2800 units N.Y. Dept. of Health	14th day of illness	4	10 "	Had tonsils removed after leaving hospital	Mild rachitis	Cervical lymph nodes removed after leaving hospital
9	Henry R.	M.	9 "		8 mos.	1500 units N.Y. Dept. of Health	4th day of illness	1	6⅔ "	Enlarged tonsils, Pharyngitis, Coryza	Rachitic funnel-shaped thorax	One year later had pneumonia.
10	Max L.	M.	29 "		1 year	1600 (dry) units 1000 (filtered) units N.Y. Dept. of Health	2d day of illness	3	7 "	Enlarged tonsils, Post-nasal catarrh, Adenoids	Rachitic, Harrison's groove, carious teeth	Since leaving hospital, pneumonia, laryngitis and strabismus. Returned after five years with mild diphtheria. (No intubation).

HOSPITAL CASES: 10.

8 cases required one intubation
1 case required three intubations
1 case required four intubations

DAY OF THE DISEASE.

4 cases were intubated on the 2d day of illness
1 case was intubated on the 3d day of illness
2 cases were intubated on the 4th day of illness
1 case was intubated on the 5th day of illness
1 case was intubated on the 9th day of illness
1 case was intubated on the 14th day of illness

One case intubated seven years ago has had no illness since. Four cases intubated six years ago are in excellent health to-day. One case has remained entirely well. One case had enlarged cervical lymph nodes. One case had pneumonia one year later. One case had pneumonia and paralysis and five years later had a second attack of diphtheria, but no laryngeal stenosis.

Five cases intubated three years ago are in good condition to-day. Three had measles and bronchitis after recovery. One has not had a day's illness since intubation. One case had a mild attack of croup two years after intubation, but did not require reintubation.

Rachitis seems to play an important part in the causation of laryngeal stenosis, just as we know that rickets is met with in laryngismus stridulus. Eight cases out of the 10 reported in this series showed some form of rickets.

There seems to be a certain predisposition for the development of laryngeal stenosis in children affected with diphtheria who are rachitic.

Condition of the Throat.—In all of the cases of this series some form of chronic tonsillar or pharyngeal condition was found. Adenoids were also seen in 2 of these cases. Whether or no the hypertrophied tonsils seen in these cases were present at the time of intubation is not known. The fact that 8 cases out of 10 still showed enlarged tonsils, and 1 case, which makes 9 cases, reported having had a tonsillotomy performed, proves that hypertrophied tonsils must have menaced the children's health before the diphtheria.

Feeding During Infancy.—It is certainly an interesting fact that all of the children in this series were breast-fed. When abnormal conditions, as rickets, scurvy, tuberculosis, syphilis,[1] or other undermining disorders exist, then recurring stenosis of the larynx might possibly be provoked by such chronic disease.

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[1] Read article on "Syphilitic Stenosis of the Larynx" in chapter on "Syphilis," page 720.

These cases of recurring stenosis sometimes require months and, in rare instances, years of intubating until recovery takes place. I have seen at least 6 chronic tube cases while making my rounds in the wards at the Willard Parker Hospital. Intubation has, in America, entirely replaced tracheotomy for the relief of acute laryngeal stenosis. Rubber tubes are used exclusively for intubation. The old metallic tubes have long ago been discarded. Tracheotomy is used as a secondary operation, usually to cure "retained tubes." When laryngeal stenosis persists and the patient cannot get along without the tube then a tracheotomy is resorted to.

A very interesting series of papers, describing the above condition, has been published by J. Rogers, Jr., under the title of "Postdiphtheritic Stenosis of the Larynx" (Retained Intubation Instruments and Retained Tracheal Cannulæ).

Rogers says: "The commonest cause of postdiphtheritic stenosis necessitating long-continued intubation is a hypertrophy of the subglottic tissues accompanied by a chronic inflammation. The intubation is in no way the cause of this, as it occurs irrespective of the operation. *Less often there is an ulceration*, and *subsequently* a formation of a greater or less amount of *cicatricial tissue and contraction*. This likewise is not the result of the intubation except in rare, and practically unavoidable, instances. But it certainly may follow a tracheotomy, and in a larynx, already chronically stenosed, it makes the condition worse, but not necessarily more difficult to cure. *Exuberant granulations within the larynx apparently do not occur with intubation, no matter how prolonged.* I should add that in a recently published book on 'Tubage et Tracheotomie en dehors du Croup,' by Antoine Sargnon, of Lyon, France, a half-dozen more cases of retained tubes are cited, in which ulceration and cicatrization are mentioned as causes of the stenosis, but without details; and, as I could not find the original references, I cannot well discuss them."

The frequency of the occurrence of a postdiphtheritic stenosis accompanying intubation is a matter of some interest. Dillon Brown says that he has encountered it about once in every 75 or 100 cases.

C. G. Jennings, of Detroit, with an equally large experience, says that he has never met with the severer forms of the difficulty, but that in two or three instances he has had to continue the intubation as late as the third week after the first insertion, before recovery was complete. His associate, Shurley, has never had any trouble with delay in the removal of the tube. Galatti, in the article above referred to, states that he had 2 chronic stenoses in 31 intubations. He reports Ranke as having had 1 case in many hundred; Heubner, 1 in 250, and Bókay 2 in 800. George McNaughton, of Brooklyn, says that he has had but few cases in many hundred, and these recovered at the latest within several weeks.

At the Nursery and Child's Hospital of New York City there have been

TABLE No. 85.—*Series of Private Practice Cases.*

No.	Name.	Age.	Sex.	Location of Membrane.	Case of	No. of Anti-toxin Units Used.	Time of Intubation, Day of Dis.	Tube Retained.	No. of Intubations.	Condition of Throat.	Complications.	Results.
1895												
1	W.	2 yrs.	M.	Pharynx, tonsils, larynx	Dr. A. W. Newfield	2500 units	2d day	4½ days	1	Tonsils enlarged	None	Cured
2	R.	2 "	F.	Pharynx and larynx	Dr. H. J. Boldt	3000 "	3d "	26 "	4	Pharyngitis, tonsillitis	Septic case, nephritis	
3	S.	5 "	F.	Larynx	Dr. L. Kohn	3000 "	5th "	14 "	3	Tonsils enlarged	None	Cured
4	R.	3 "	M.	Pharynx, tonsils, larynx	Dr. O'Connell and Dr. A. Bienenstock	2000 "	2d "	12 "	2	Chr. pharyngitis, hypertrophied tonsils	None	Cured
5	K.	4 "	M.	Pharynx and larynx	Dr. A. W. Newfield	2000 "	3d "	5 "	1	Hypertrophied tonsils	None	Cured
6	A.	5 "	M.	Pharynx tonsils, larynx	Dr. Emil Joel, Children's Dept. Ger. Pol.	2000 "	2d "	5 "	1	Hypertrophied tonsils	Bronchitis	Cured
1896												
7	D.	4 "	F.	Pharynx, uvula, larynx	Dr. S. Landsman	2500 "	3d "	6 "	1	Adenoids, hypertrophied tonsils	None	Cured
1897												
8	B.	3 "	M.	Pharynx and larynx	Dr. L. Bischof	2000 "	3d "	5 "	1	Hypertrophied tonsils	None	Excellent
9	R.	3 "	M.	Pharynx, tonsils, larynx	Dr. A. Bienenstock	4000 "	2d "	6 "	1	Adenoids, hypertrophied tonsils	None	Excellent
1898												
10	A.	3 "	M.	Pharynx and larynx	Dr. E. Lowenbein	2000 "	3d "	6 "	1	Hypertrophied tonsils	Measles	Coughed up tube. Asphyxiated
11	S.	4 "	F.	Pharynx, tonsils, larynx	Dr. M. Ghertler	3000 "	2d "	7 "	1	Hypertrophied tonsils, pharyngitis	None	Excellent
12	K.	2 "	M.	Tonsils, uvula, pharynx	Dr. Th. Manley	2500 "	3d "	5 "	1	Adenoids, hypertrophied tonsils	None	Excellent
13	G.	3 "	F.	Pharynx. tonsils, larynx	Dr. Geo. Saxe	1500 "	2d "	5 "	1	Hypertrophied tonsils	None	Cured
1899												
14	L.	2 "	M.	Larynx	Dr. H. Sheffield	1500 "	1st "	22 "	5	Hyper. tonsils, chronic rhinopharyngitis	Br.-pneu.	Cured
15	L.	3 "	M.	Pharynx and larynx	Dr. D. Jacobson	2000 "	3d "	14 "	3	Enlarged tonsils	None	Cured
1900												
16	O'M	5 "	M.	Pharynx and larynx	Dr. C. Campbell	2000 "	2d "	5 "	1	Adenoids, hypertrophied tonsils	None	Cured
17	C.	3 "	M.	Pharynx, tonsils, larynx	Dr. A. Fanoni	3000 "	3d "	5 "	1	Chr. pharyngitis, chr. tonsillitis, vegetations	None	Cured
1901												
18	H.	4 "	M.	Pharynx, larynx, tonsils	Dr. A. Rose	3000 "	2d "	5 "	1	Hyper. tonsils, adenoid vegetations	None	Cured
19	S.	3 "	F.	Pharynx and larynx	Dr. S. Landsman	2000 "	3d "	6 "	1	Hypertrophied tonsils	None	Cured
20	P.	4 "	F.	Pharynx and larynx	Dr. C. Hoffman	3000 "	2d "	25 "	5	Rhinopharyngitis, hyper. tonsils	None	Cured
21	B.	5 "	F.	Pharynx, tonsils, larynx	Dr. H. Weinstein	2000 "	3d "	6 "	1	Chronic tonsillitis, adenoid vegetations	None	Cured
22	M.	4 "	F.	Larynx	Dr. H. Groebl	3000 "	5th "	6 "	2	Hypertrophied tonsils, adenoids	None	Cured
23	R.	11 mos.	F.	Larynx and tonsils	Dr. W. H. Kahrs	1500 "	2d "	7 "	1	No adenoids or enlarged tonsils visible	Br.-pneu.	Excellent
24	G.	4 "	F.	Larynx, tonsils, pharynx	Dr. A. E. Isaacs	2500 "	3d "	5 "	1	Enlarged hypertrophied tonsils	None	Cured
25	C.	4 "	M.	Pharynx, tonsils, larynx	Dr. A. W. Newfield	4000 "	2d "	12 "	3	Hyper. tonsils, granular pharyngitis	None	Cured
26	K.	2 "	F.	Tonsils, pharynx, larynx	Dr. S. Landsman	[illegible]000 "	2d "	6 "	1	Adenoid vegetations, hyper. tonsils	None	Cured

no noticeably prolonged intubations. The New York Foundling Hospital has had 6 cases in a total of approximately 500. Investigation of the statistics at this institution forcibly illustrates the advantages in the use of the diphtheria antitoxin. The house physician complained to Dr. Rogers that before the introduction of this remedy his predecessors had always averaged at least one intubation a week, and thereby obtained much valuable experience; but about the time he came into the hospital, the rule was instituted that antitoxin should be given to very patient as soon as there was any suspicion of diphtheria. The result was that he had never in a year's service had a single opportunity to practice intubation on a living subject.

Number of Intubations.—In the above series 1 case required four intubations. Another case required three intubations. The majority required but one intubation to effect a cure.

Kind of Antitoxin Used.—The antitoxin employed at the Willard Parker is made at the laboratory under the supervision of Dr. Wm. H. Park, of the New York City Department of Health.

Method of Intubation Employed at the Willard Parker Hospital.—The dorsal method of intubation is the one advocated by Dr. E. G. Bryant and Dr. Thos. De L. Burckhalter at the Willard Parker. The advantage claimed for it is that we can do without assistants, which in an emergency is a great advantage. I have used this method and agree with Bryant that it is preferable to the upright position advocated by O'Dwyer. (See Figs. 184 to 187.)

The dorsal position in intubation is also used and advocated by Casselberry of Chicago; Carstens of Leipsic is another strong advocate of it.

Second Series. Children Intubated in Private Practice.—The children of this series were seen in consultation with the family physician, excepting 1 case (Case 11), which was referred to me for personal treatment. They belong to the better class of children, which implies better sanitary surroundings, better food and prompt medical aid when the first symptoms of illness are noticed. It was much easier to study this series of cases, as the physician in attendance, as a rule, gave me the required data.

Case X should be excluded in this study, as the child coughed up its tube (autoextubation) and died of asphyxia before the physician arrived. Case IX must also be excluded, as it was impossible to obtain satisfactory details concerning the progress of the case after it recovered from the diphtheria.

6 cases were intubated 8 years ago
1 case was intubated 7 years ago
4 cases were intubated 5 years ago
2 cases were intubated 4 years ago
2 cases were intubated 3 years ago
9 cases were intubated 2 years ago

One of the cases in this series contracted scarlet fever and died two years after intubation. So that 3 cases out of this series must be excluded. leaving 23 cases from which reports have been received.

DAY OF THE DISEASE.

1 case was intubated on the 1st day of illness
11 cases were intubated on the 2d day of illness
9 cases were intubated on the 3d day of illness
2 cases were intubated on the 5th day of illness

NUMBER OF INTUBATIONS REQUIRED.

15 cases required one intubation
2 cases required two intubations
3 cases required three intubations
1 case required four intubations
2 cases required five intubations

LENGTH OF TIME THE TUBE WAS WORN.

1 case 26 days
1 case 25 days
1 case 22 days
2 cases 14 days
2 cases 12 days
2 cases 7 days
5 cases 6 days
8 cases 5 days
1 case 4 1/2 days

The average length of time the tube was worn in the above 23 cases was 9½ days or 228 hours.

Rachitis.—In this second series of cases we are dealing with children brought up in excellent surroundings. In the families of the better class in New York City the majority of mothers do not nurse their own infants. Wet-nurses are not commonly employed. Thus the larger number of these children are to-day brought up by bottle feeding. It is, therefore, no wonder that in the present series of cases rickets due to malnutrition or inanition was very frequently encountered. The susceptibility of the rickety child has frequently been mentioned by many authors. In this second series of cases rachitis was associated in 19 cases.

Condition of the Throat.—Not one of these cases had a normal throat at the time of the intubation. Adenoid vegetations, enlarged tonsils, and chronic rhinopharyngitis were met with in almost every case. When the danger of a diphtheritic laryngeal stenosis in a child is considered, then it is certainly important to urge the removal of hypertrophied tonsils or adenoids if present, and to restore normal conditions in the rhinopharynx if possible. Greater attention should be bestowed on the nose, as the most fatal cases are those of nasal diphtheria in which general sepsis follows.

After-effects Resulting from Intubation.—While some physicians have reported the existence of a bronchial catarrh during the first and second winter months following intubation, the majority of these 16 cases reported absolutely normal conditions. Two cases have had pneumonia, in one child five years after intubation and in the other child three years after intubation.

One very interesting case in this series was a child (an idiot) 4 years old, seen in consultation with Dr. C. Hoffman. This was one of the most trying cases and required five intubations extending over a series of twenty-five days. The child made a splendid recovery. Such cases in private practice must be invariably supervised by a trained nurse. In this particular case careful feeding in addition to competent nursing was the means of saving the child's life.

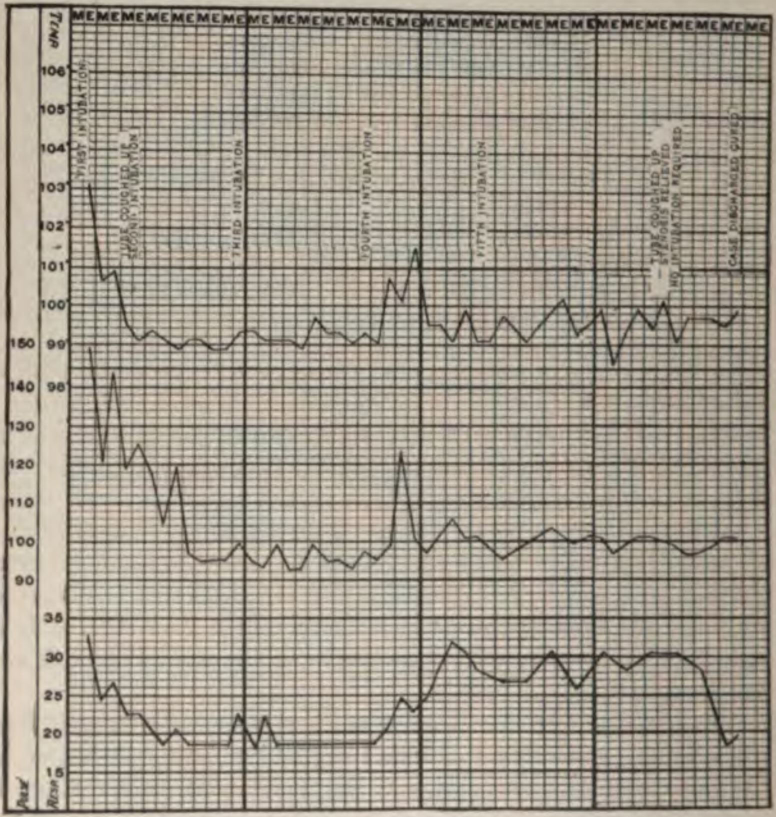

Fig. 192.—Laryngeal Diphtheria. Child 4 years old; mentally deficient. Seen in consultation with Dr. C. Hoffmann. (Original.)

Constant cough or laryngitis lasting many months was encountered in 4 cases of my series. All in all, there is no case in my series in which a *distinct* bronchial or laryngeal catarrh could be traced to or associated with *the intubation.*

Rogers says: "As regards the etiology of postdiphtheritic stenosis of the larynx and retained intubation tubes, the views of the late Dr. O'Dwyer are, of course, worthy of the greatest consideration. Nevertheless, I believe they are wrong. He maintained that the condition was the fault either of the operator or of the instruments, which means careless or unskilled insertion, or the use of poorly constructed, and, therefore, improperly fitting tubes. Formerly, while he was experimenting with and perfecting his instrument, he sometimes encountered ulcerations and granulations; and the 2 cases he reports of granulations at the base of the epiglottis, where it impinged upon the head of the tube, might properly be counted in this class. At all events there is no other record of a similar occurrence from the use of *the hard-rubber* tube as at present made. It must be admitted, however, that erosions and ulcerations are possible with a metal tube, as its surface soon becomes rough from a deposit of what is apparently calcareous matter. But whether ulcerations and subsequent cicatrices may not be thus produced has very little to do with the matter, as they do not seem to be the usual cause of the stenosis in the reported cases. . . . And it is important, from a medico-legal aspect, as well as for the sake of intubation, to show that neither the operator nor tube, ordinarily, has anything to do with a possible postdiphtheritic stenosis. It is granted that lacerations and serious permanent damage to the larynx can, of course, be inflicted by extreme lack of skill or care; but to claim that this must have happened in all, or even some, of the cases of retained tube is not borne out by the facts. A certain amount of traumatism is necessarily inflicted at every intubation, and if, by any chance, a chronic stenosis follows, the traumatism is always blamed for it. That this is wrong, at least in the average case, is proved to my mind by the pathology of the condition. It is the same whether the stenosis follows intubation or a primary tracheotomy."

Causes of Recurring Stenosis.—Emil Köhl, in his inaugural address at Zurich, in 1884, described very fully the pathological condition of the larynx in cases of chronic postdiphtheritic stenosis with retained tracheal cannula. This article demonstrates most conclusively that not the least frequent cause of the difficulty is a chronic hypertrophic, subglottic laryngitis, a chronic thickening of the soft parts between the vocal cords and the lower border of the cricoid cartilage. The hypertrophy of the soft tissue was so marked that respiration, except through tracheal fistula, was impossible. These cases, of course, had never been intubated; and, therefore, the chronic inflammation within the larynx cannot be charged to the irritation or traumatism consequent upon the insertion or wearing of an intubation tube.

Another and more frequent cause of the stenosis was shown to be granulations and cicatrices in the neighborhood of the tracheal wound or cannula. And the nearer the cannula was to the vocal cords the worse were these complications. The vicinity of the upper end of the wound was more prone to granulations and cicatrices than the lower, as the upper end generally involved or was close to the larynx, where the mucous membrane is more loosely attached than below. This bears upon the cause of the stenosis described in some of the reported cases of retained tubes which have finally been tracheotomized. If the tracheotomy has existed long enough, it, and not the original intubation, may have given rise to the cicatricial tissue.

Incidentally, it may be noted that the number of devices described by Köhl for remedying a postdiphtheritic stenosis will illustrate the difficulties in the way of successful treatment other than by intubation.

In speaking of the operative treatment of stenosis of the larynx following intubation and tracheotomy, Arthur B. Duel says: "The important points to remember: (1) About 1 per cent. of all patients intubated for acute laryngeal stenosis will 'retain' the tube. (2) The cause of the retention is due, in the majority of cases, to chronic inflammation of the intralaryngeal mucous membrane and hypertrophy of the subglottic tissues, and is not, as has been generally supposed, the result of granulation, ulceration, or cicatricial bands. (3) Autoextubation in these cases is the rule, and adds greatly to the danger where an experienced intubator is not at hand. As a result of this a large number of such cases are tracheotomized for safety. (4) Where high tracheotomies are done, cicatricial bands are almost certain to form in the trachea or lower part of the larynx above the tracheotomy wounds."

The points in treatment which should be emphasized are: (1) The largest sized tube possible should be inserted, under an anæsthetic. In case of contraction, rapid dilatation should be done by beginning with the small sizes and working up to the large special tube, which is to be left in place. This special tube should be as large as can be inserted, and the constriction below the neck only $^1/_{32}$ inch smaller than the retaining swell. (2) This tube should be left in, undisturbed, for six weeks at least. It should then be removed, and, if a cure has not been accomplished, it should be replaced for six weeks longer.

To illustrate the above the following case may be cited:—

Child B., 2 years old, was seen by me in 1895, in consultation with Dr. McConville, of Brooklyn. The child had had a severe pharyngeal, tonsillar and laryngeal diphtheria. The temperature was 101° F., pulse 140, respiration labored. Child cyanotic. I intubated with a No. 2 metal tube, which immediately relieved the laryngeal stenosis. The general condition of the child improved greatly and three days later I was requested to extubate. Several minutes after extubation marked laryngeal stenosis recurred so that a second intubation was necessary. The child's condition again improved, and when normal conditions prevailed, in about four days I was again requested to extubate. Thus the child was intubated and extubated every four days for a month. As the family were unable to retain the services of a competent trained nurse, and as the child required frequent medical supervision, the case was transferred to the Gouverneur Hospital. Dr. Rogers treated this case as he does all of his "retained tube" cases by introducing the largest sized tube that can be worn, and allowing the tube to remain *in situ* four, five or six weeks before extubating. After one month of this treatment I was informed that extubation permanently relieved the condition and the child was discharged from the hospital cured.

Paralysis of the Vocal Cords.—Very many cases have been reported by competent observers on both sides of the Atlantic. In America, Waxham, Rosenthal, Engelmann, myself and many others; in Europe, von Bókay, Trump, Egidi, Galatti, Massei, and Escat.

Intubation in Hospital Practice.—There is a decided difference between intubation in a hospital and intubation in private practice. In the Willard Parker Hospital, New York, there are always several physicians ready to intubate at a moment's notice. I have seen more than one case of mild stenosis, treated with antitoxin and careful dietary, get well without intubation. Haste is not necessary, and each case is carefully treated. When intubation was not regarded as sufficient relief I have seen several cases tracheotomized by the assistant resident physician, Dr. Beery, with excellent results.

Intubation in Private Practice is an entirely different matter. Johann von Bókay in his review regarding intubation published in the "Transactions of the Section on Diseases of Children," held at Hamburg, 1901, honors me by the following quotation[1]: "Auch halte ich das Vorgehen von Louis Fischer, des hervorragenden intubators aus New York, für unrichtig, der sagt: Ich mache es mir zur Regel—wenn ich sicher den Nachweis liefern kann, dass es sich um eine Diphtherie handelt und ich das Vorhandensein des Klebs-Löffler-Bacillus constatirt habe, die intubation sofort vorzunehmen, wenn *sich die geringste Stenose* zeigt."

While his statement is partly true, it does require a slight modification. When a mild case of laryngeal stenosis is encountered in private practice, then judgment must be used regarding the time for intubation. The points to be considered are: the distance at which the patient lives, the amount of diphtheritic infection that we are dealing with, and the circumstances of the people in which the case occurs. If the child is fortunate enough to be under the observation of a competent nurse, who can recognize the slightest increase in the stenosis, watches the condition of the heart, and calls the physician the moment the slightest danger arises, then the conditions are most satisfactory and we can wait with intubation, otherwise we are compelled to intubate when slight evidences of stenosis appear. *I do not advocate intubation the moment stenosis exists.* In Case XXI of my series of private cases above reported, seen in consultation with Dr. Harry Weinstein, the stenosis of the larynx was treated by an injection of antitoxin, the child placed under the care of a competent trained nurse with detailed instructions *regarding progressive symptoms. Twelve hours later,* when the *stenosis increased* in severity, I was summoned hurriedly to intubate. In this case the child wore the tube six days, and required but one intubation to complete the cure of the stenosis. In America the majority of intubated cases occur in private practice. Von Bókay states that according to Jacobi, only 5 per cent. of diphtheritic laryngeal stenosis are treated in the special (Willard Parker) hospital. The rest, 95 per cent., occur in private practice.

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[1] My rule is to intubate when the slightest stenosis exists, provided the clinical diagnosis of diphtheria has been verified by the bacteriological diagnosis.

The smooth rubber tube with or without metal lining is now generally used for the relief of laryngeal stenosis. Smooth rubber tubes, with a retaining swell, the advantage of the same over the metal tube in not having calcareous deposits after being worn for weeks is certainly noteworthy. The corrugated rubber tubes which were introduced by me several years ago have certainly served me very well in many cases of "retained tube."

The following case occurred in the practice of Dr. A. W. Newfield. The child was about 4 years old, and had suffered for several years with hypertrophied tonsils and adenoid vegetations, in addition to chronic pharyngitis. The family physician advised the parents to have the throat operated owing to the danger of infection with diphtheria. This prophylactic measure was not carried out. I saw the case on the second day of illness, in consultation with Dr. Newfield, and found diphtheria involving the pharynx and tonsils which spread very rapidly to the larynx. The same day intubation was required to relieve a severe stenosis. The stenosis was so severe when I saw the child, and the pulse so weak, that it required a rapid introduction of the tube to afford relief. An injection of 3000 units of antitoxin was given. Three days later a second injection of 3000 units was made; so that 6000 units were injected in all. There was recurring stenosis when the tube was removed. It was necessary to intubate within ten minutes. Extubation was performed once every five days, and reintubation was necessary a few minutes to one-half hour after removing the tube. Rubber tubes only were used in this case. After the second intubation an alum gelatine film was used on the tube.

After the third intubation it was deemed necessary to use a corrugated tube dipped in a solution of hot gelatine containing 3 per cent. of ichthyol and alum. This tube was worn about five days. After the extubation the child breathed well for about one hour without a tube. A mild form of stenosis was noticed and it was deemed safe to reintubate with an ichthyol alum gelatine film on a No. 4 corrugated rubber tube. This tube remained about six days and was then removed. Stenosis did not recur and the case was discharged cured. Later on the adenoids and hypertrophied tonsils were removed and the child has been well since.

Conclusion.—All the children in both these series that recovered had been breast-fed. This form of feeding must have had an important bearing on their bony development as well as their muscular structure.

No chronic cough which could be attributed to the wearing of the tube was encountered. It was presumed by me at the outset of my investigation, that I might meet with a series of cases of chronic laryngitis, chronic tracheitis and chronic bronchitis, dating back to the intubation. We know that pressure of the tube has frequently caused decubitus; hence, it is presumed that an inflammatory process might be invited from the wearing of the tube. Comparing an equal number of children of the same age and development who never suffered with diphtheria, nor were intubated, it was found that they suffered with pneumonia and other infectious diseases in the same proportion as children in my series of cases. This would seem to be a splendid argument in favor of intubation, as it shows two important points:—

First.—The tolerance of the larynx to a tube for many weeks, one of my cases having worn a tube twenty-six days, another case twenty-five days.

Second.—That a properly fitting tube constructed of rubber leaves no evidence of chronic inflammation directly traceable to the tube. In every one of my cases I questioned carefully if any catarrh originated from, or could be associated with, the wearing or removal of the tube, and received negative replies.

Equally interesting was it to study the contour of the thorax and to see if the development of the thorax suffered by reason of these children wearing tubes.

In spite of the fact that the large majority in the first series as well as in the second were decidedly rachitic, no deformity of the chest due to imperfect oxygenization could be attributed to the effects of the intubation tube. An etiological factor and one on which a great deal of stress has already been laid, is that 90 per cent. in my first series of cases suffered with chronic throat disease in some form, such as hypertrophied tonsils, chronic pharyngitis, or adenoids. In some all of the above conditions were apparent.

It is safe to presume that chronic throat disease invites infection, and I believe that there is a direct relationship between the seed and the soil. If children's throats are in a normal condition, then the risk of infection is reduced to a minimum. It is our duty, therefore, to urge all mothers to have diseased conditions removed, and thus try to prevent the infection of diphtheria, which is certainly a serious condition.

RECURRING LARYNGEAL STENOSIS FOLLOWING INTUBATION AND DECUBITUS.

Etiology.—This condition is primarily caused by forcibly pushing a tube into an œdematous or infiltrated mucous membrane. O'Dwyer says that it is caused by using a tube that is too large for the lumen of the larynx; usually in the hands of inexperienced operators. Metallic tubes that have been worn for a long time contain large calcareous deposits—the latter are due to a deposit of lime salts contained in the diphtheritic membrane—and when removing such a tube during extubation, the mucous membrane is easily lacerated, and thus ulceration is caused thereby. One of the most important papers given to the profession was read by the late

Joseph O'Dwyer.[1] In his paper entitled "Retained Intubation Tubes" he says: "The cause of persistent stenosis following intubation in laryngeal diphtheria can be summed up in the single word 'traumatism.' Paralysis of the vocal cord may possibly furnish an occasional exception to this rule."

Thus an injury to the larynx can be done by a tube that does not fit; it may result from an imperfectly constructed tube, or from a perfect tube that is too large for the lumen of the larynx, although proper for the age, or from a tube that is perfect in fit and make if not cleaned at proper intervals. O'Dwyer states that the seat of the lesion that keeps up the stenosis is just below the vocal cords in the sub-glottic division of the larynx, or that portion of the organ bounded by the cricoid cartilage. Exceptions to this rule result from injury produced by the head of the tube on either side of the base of the epiglottis, just above the ventricular bands. The reasons given by O'Dwyer for the existence of the stenosis at this particular portion can best be explained by the following:—

Pathology.—Anatomically, normally, there exists a constriction in the cricoid region. When the mucous membrane infiltrates or gets œdematous it swells to such an extent and only toward the center, as the outside is surrounded by cricoid cartilage; and while swelling toward the center, mechanically impedes respiration and thus calls for mechanical relief, *i.e.*, intubation. O'Dwyer states that if a tube is forced into the larynx in a case of this kind, ulceration and sloughing of the tissues is inevitable, and in some instances necrosis of the cricoid cartilage can result from interference with the circulation. Our only safeguard in preventing too much mechanical injury as in the condition above cited is to introduce "a tube of small caliber."

In the early stage of this form of cases the dyspnœa returns slowly; sometimes several days, or in some instances only a few hours, may pass before the former condition of laryngeal stenosis is recognized and the necessity for the introduction of a proper tube is demanded.

When the dyspnœa returns slowly, it means that the lining membrane of the larynx cannot swell while the tube is in position because it is compressed between the tube and the cartilage. It requires some time for the reappearance of the œdematous tissue, which drops into the chink of the glottis and obstructs the respiration, the latter condition being mechanically prevented as long as the tube was *in situ*. Exceptional cases have been reported where granulation tissue springs up from the antero-lateral aspects of the larynx just above the ventricular bands. O'Dwyer states that the origin of this growth is a slight ulceration or erosion of the mucous membrane at the points corresponding to the greatest transverse diameter of the shoulder of the tube from the pressure exerted during the act of swallowing.

Paralysis of the Vocal Cords, although known to exist, is very hard to diagnosticate without a proper laryngoscopic examination. Like other forms of paralysis it comes very late in the course of the disease, and if, after wearing an intubation tube for a short time, laryngeal stenosis recurs, it is safe to assume that paralysis of the vocal cords is not the cause of the immediate recurring stenosis.

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[1] American Pediatric Society, at Washington, May 6, 1897.

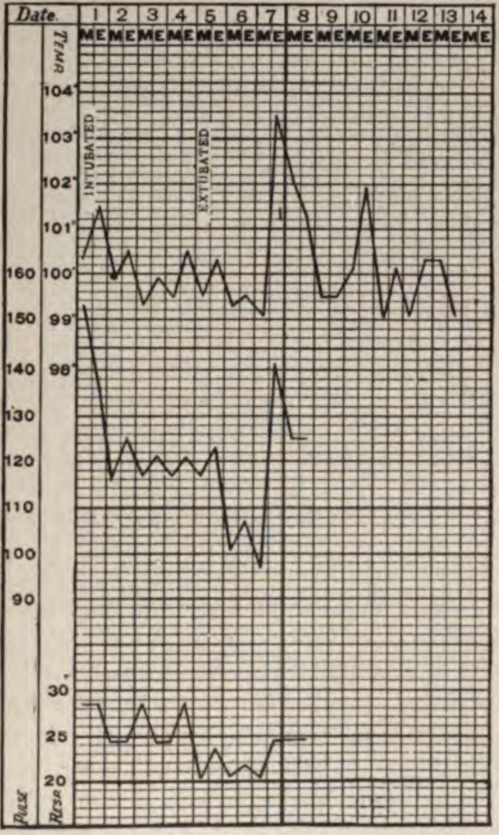

Fig. 193.—Case seen in consultation with Dr. S. M. Lansdmann. Diphtheria. Laryngeal stenosis requiring intubation. Normal conditions and extubation on the fifth day. Two days later, on the seventh day of illness, a sudden high fever, due to over-feeding, required diet and calomel. Case recovered. (Original.)

How can we prevent recurring laryngeal stenosis in ordinary membranous diphtheria? Every tube must be introduced in the gentlest manner possible, the slightest force exerted will lacerate the tissues. It is a wise rule to remove the tube every five days; according to O'Dwyer, tubes should be removed at the end of five days to avoid irritation from calcareous deposits. These deposits will *only form on metal* and *not* on the *rubber* tubes. This has been pointed out by most writers, and is borne out by experience.

Treatment.—*Intra-laryngeal Medication:* When laryngeal stenosis recurs and it is necessary to intubate several times, local medication of the larynx may do good. This is especially true if we are dealing with ulcerations caused by the end of the tube during deglutition. Ulcerations caused by the pressure of the tube are the ones known as decubitus ulcerations. They most frequently result from irritations caused by the calcareous deposits on the metal tubes. Such calcareous deposits produce irritation and finally ulceration.

O'Dwyer, many years ago, advocated the use of a gelatine film containing such medications as ichthyol or alum. The writer has for some years past used with a varying degree of success certain formulæ which have served him quite well in certain cases. The following method of coating tubes is recommended: For a child 2 years old, take a 1 year size tube and have the same coated with the following:—

French gelatine, shredded	2.0
Glycerine	2.0
Water	10.0
Ichthyol	1.0

Dissolve over a water bath and immerse the tube, being careful not to close the ends. Place the tube on pins stuck through a piece of cardboard and allow to dry. Should too thick a layer of gelatine have been acquired, hold near the spout of the water bath and allow the steam to play on the tube, causing the excess to drip off.

If we have fever and a very rapid and feeble pulse, and the general circulation is poor, with cold extremities, then tonics, such as iron and strychnine, or restoratives, such as codliver-oil and malt extract, should be ordered in addition to concentrated foods. Thus by restoring the normal condition and by assisting the nutrition we can hope for the repair and healing of superficial lesions. It frequently happens that in spite of "a medicated tube," such as above described, stenosis will recur. In order to guard against possible calamities, it is wise to have another tube with its proper medicated gelatine film ready to be used if occasion requires it.[1]

False Passage.—Repeated forcible attempts at intubation will lacerate the tissues. It is not infrequent to enter the ventricles of the larynx, producing a false passage by such forcible attempts at intubation. If a false passage has been produced, then laryngeal stenosis will not be relieved, and it is much wiser, if an expert intubator cannot be found, to immediately resort to tracheotomy. The great danger of collapse due to heart failure must always be remembered, hence it is advisable that the operation, be it intubation or tracheotomy should be done quickly thus lessening shock.

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[1] A complete paper on "Intubation with Clinical Results of Intra-laryngeal Medication" was published by me in Archives of Pediatrics, February, 1904.

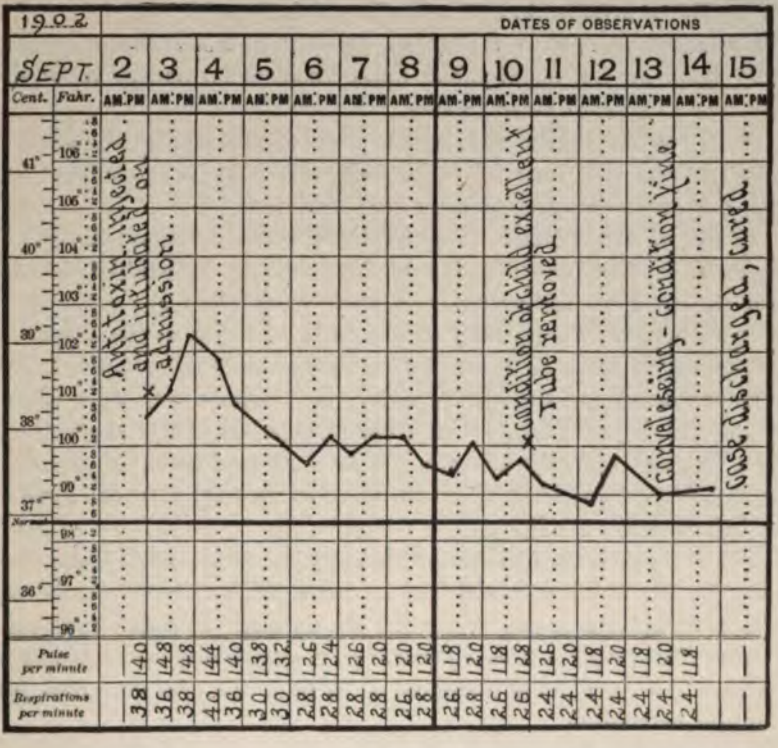

Fig. 194.—Temperature Chart from a Case of Laryngeal Diphtheria. Excellent Result of Intubation and Antitoxin. Doubtful Prognosis. Recovery. (Original.)

EXTUBATION.

How to Extubate.—First step in the operation: place gag in position; locate the tube with the left index finger; guide the extractor along the finger until the beak enters the lumen of the tube. Second step in the operation: depress the handle of the extractor to hold tube firmly, and withdraw the tube slowly. (See Figs. 186 and 187.)

When to Extubate.—Five days is a fair length of time for the tube to be left in the larynx. The following rules have served me best in a very large experience in hospital and private practice:—

Let the child's condition be the guide as to when to extubate. My advice is to leave the tube in the larynx at least *four* days, then remove the same.

The question to be considered is, can the child undergo the shock of extubation, and, if need be, reintubation.

If the temperature is over 100° F., and the pulse-rate is small, rapid, and over 120, it is better to wait with the extubation.

A rubber tube left in the larynx does not have calcareous deposits as we find them on the metal tubes, hence there is no danger in leaving a rubber tube *in situ* for several weeks.

If the tube is plugged with mucus or membrane it may be necessary to remove the tube and clean it. A rattling or crowing sound in addition to laryngeal stenosis usually indicates this condition.

At the Willard Parker Hospital there is no definite rule as to the number of days a tube remains in the larynx. Individual conditions govern the time of extubation. In some cases tubes are removed after forty-eight hours. The severity of the cases admitted to the hospital and the complication must be taken into consideration. Uncomplicated cases may be extubated any time between the third and seventh days when the œdema of the larynx subsides. In a few instances the child expels the tube without having recurring stenosis. This auto-extubation is occasionally seen; it is Nature's method of removing a foreign body after the subsidence of the inflammatory condition.

A very interesting observation recently made at the Willard Parker Hospital by Dr. William Studdiford is that a child with otitis does not do as well in extubation as one whose ears are normal. It seems quite evident that reflex disturbance caused by severe pain may finally result in spasm of the glottis. A good point therefore is to have the ears examined before attempting extubation.

Antispasmodic Treatment.—Before resorting to extubation, it has been my rule to give a large dose of bromide of sodium combined with chloral hydrate at least six hours before extubating. At the Willard Parker Hospital, morphine is sometimes used hypodermically in doses of $^1/_{16}$ to $^1/_8$ of a grain, depending on the age and strength of the child to be extubated. This method is very successful, especially when all evidence of diphtheria has passed, and it is simply necessary to relieve peripheral irritation to avoid spasm.

CHOICE BETWEEN INTUBATION AND TRACHEOTOMY.

In cases where operation is indicated it may be said that intubation has steadily grown in favor, and its advantages, when it is indicated, are so obvious as to require no recapitulation here. On the other hand, conditions are sometimes present that render intubation impracticable or inadmissible, or at least render tracheotomy preferable. It is therefore desirable to keep clearly in mind the factors that determine the choice in favor of one or the other of these operations. This subject has received consideration in a study, by Drs. George Alsberg and Sigmund Heimann, of the cases of diphtheria, to the number of 4033, observed at the Kaiser und

Kaiserin Friedrich Kinderkrankenhaus, in Berlin, for the ten years from 1891 to 1900. As a result of this analysis it is concluded that operative intervention in cases of stenosis of the larynx of slight and moderate degree should be obviated as far as possible by means of antitoxin and the employment of sprays. Primary intubation is indicated in all cases of stenosis of the larynx of severe degree, in which, so far as the clinical picture makes it appear possible, a cutting operation can be avoided. Primary tracheotomy is indicated in the presence of asphyxia and collapse, of pneumonia, of severe heart disease, of paralysis of the palate and diaphragm, of profound anatomic changes in the pharynx, as well as marked tumefaction of the entire pharyngeal structures when necrotic.

Secondary Tracheotomy is indicated when the symptoms of stenosis persist in marked degree with the tube in place, providing its lumen is not occluded, when pneumonia supervenes, and when paralysis of the palate and diaphragm supervenes. Intubation is not recommended in nursing infants by some writers on account of the diminutiveness of the parts and of the narrow lumen of the pharynx, but especially on account of the increased difficulty in feeding from the presence of the tube, which at this time of life is of vital importance. My personal experience is just the reverse, and my results have been excellent.[1]

TRACHEOTOMY (IN ACUTE OR SUBACUTE LARYNGEAL STENOSIS).

If laryngeal stenosis persists in spite of intubation, then secondary tracheotomy is indicated. When extensive œdema of the larynx exists, in which case intubation fails to relieve, tracheotomy may be required. I have frequently met surgeons who were well posted on tracheotomy, but were not familiar with the delicate *modus operandi* of intubation.

If laryngeal stenosis threatens life, and the physician is not acquainted with the method of intubation, then by all means perform tracheotomy, rather than risk "experimental intubation."

When emergencies arise they should be met by quick action. An interesting case of suffocation due to laryngeal stenosis was told to me by my friend, Dr. George F. Shrady:—

> A child suffering with croup suddenly collapsed and was thought dead, when Dr. Shrady, in the emergency, took a razor which was handy and made an incision into the trachea. He used a bent hairpin instead of a tracheal dilator. The child breathed as soon as oxygen was admitted. The case recovered.

I have seen cases successfully tracheotomized by Dr. Throne and Dr. Beery, and have also assisted Dr. Burckhalter in performing tracheotomy at the Willard Parker Hospital, when intubation did not relieve laryngeal stenosis—as in subglottic œdema.

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[1] See case of Baby R. in the practice of Dr. Kahrs, "Intubation in Private Practice."

The Operation.—*Anæsthetic:* If time permits, a few drops of chloroform should be given. If septic stupor exists then no anæsthetic should be given.

The high operation "tracheotomie superieure" in which the incision is made in the upper portion of the trachea is preferred to the lower operation advised by Trousseau, known as "tracheotomie inferieure."

The upper portion of the trachea is quite superficial and it is best to make an incision exactly in the *median line,* at least two inches in length. It is important to remember that the branches of the inferior thyroid veins are immediately under the place chosen for the operation, hence the parts must be carefully dissected with a blunt instrument, such as the back of a scalpel, until the trachea is reached. If there is severe bleeding the veins should be seized with a forceps unless emergency demands rapidity of action. The dissection should be continued until the trachea is reached. When there is considerable oozing of blood, and our view is thus obstructed, we must remember to keep in the center of the throat, which invariably brings us to the rings of the trachea. By placing the finger in the wound we will feel the respiratory movement of the trachea. When the trachea is reached it should be hooked up with a tenaculum and an incision made large enough to admit the tracheotomy tube. The rush of air, so-called *tubal sound,* characteristic of intubation, is also heard when tracheotomy is properly performed.

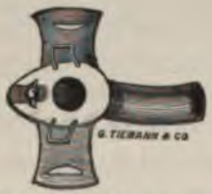

Fig. 195.—Silver Trachea Cannula used in tracheotomy.

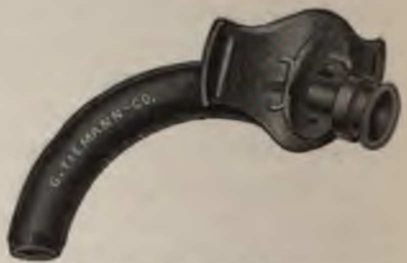

Fig. 196.—Hard Rubber Trachea Cannula.

After-effects of the Tracheotomy Tube.—The presence of the tube in the trachea invariably excites cough. This expels loose membranes and other viscid accumulations. High fever sometimes follows this operation, although as a rule the temperature will only reach 101° or 102° F.

The pulse-rate should be carefully observed; a gradually increasing pulse-rate during the first three days after the operation is a very bad sign.

Complications.—Broncho-pneumonia and nephritis are to be feared, for they frequently terminate fatally. The treatment of complications is the same as though the disease existed independent of the operation.

After-treatment.—Careful aseptic methods must be the rule from the moment the child's stenosis is relieved. The infection of the wound will always be an added source of danger. As the majority of cases of tracheotomy will be performed for extensive pseudomembranous stenosis, we must remember that septic diphtheria *per se* may cause death independent of the added danger incident to the opening of the trachea. All oozing of blood must be checked; pressure with sterile gauze saturated with Monsell's solution has served me well. I have also used gauze dusted with a powder consisting of:—

℞ Europhen	7 parts
Alum	3 parts

To Check Hæmorrhage.—The local application of adrenalin solution, 1 to 5000, is very valuable during the operation.

The internal cannula should be removed and cleaned every two or three hours, wiped dry and replaced. In rare instances it may be necessary to cleanse the cannula less frequently. This can best be determined by watching the respirations and instructing the trained nurse as to when the caliber of the tube requires cleansing. Noisy, rattling sounds due to the presence of mucus in the tube do not necessarily mean that the cleansing of the cannula is urgent, if the child is quiet or asleep. If the child is restless and turns its head from side to side, and usually mucus rattling is heard in addition, then it is an indication for cleansing the tube.

Cleansing the Wound.—Each day following a tracheotomy, it is advisable to place the child on the operating table, withdraw the tracheotomy tube and replace it with a new one.

A writer states that "after the second or third removal the larynx should be examined to see if it is free and there is no further use for the cannula." My experience with tracheotomized cases has not been as good as that, for rarely have I seen a tracheal cannula that could be dispensed with, although antitoxin was administered, in less than seven to twenty-one days. The severity of my cases may account for the difference in experience. At times, in spite of the greatest amount of care, even in the hands of experienced operators, cicatrices of the trachea resulting in permanent contraction or exuberant granulations at the site of incision will require the continued use of the tracheotomy tube, as in cases described in the chapter on "Intubation," known as "retained tube cases."

CHRONIC DIPHTHERIA.

There are two varieties which characterize this condition.

The first form is simply the continuation of an acute attack of diphtheria, running a prolonged course. Second, a chronic form in which symptoms of pseudo-membranous rhinitis exist and which may be present months or years.

In the prolonged type previously mentioned, fever, glandular swelling and general systemic disturbances mark the beginning of the attack. In the latter type the febrile manifestations and general constitutional disturbances are totally absent.

Diagnosis.—The clinical picture of the chronic type of diphtheria narrows down to two distinct features. First, the presence of pseudo-membranes in the nose, pharynx, or larynx, for months or years. Second, the persistence of the Klebs-Loeffler bacillus. Third, the marked absence of general constitutional disturbances.

Neisser, v. Behring, Walb, and more recently Newfield,[1] describe this form of diphtheria. He found that a series of cases of rhinitis atrophicans and ozæna showed Klebs-Loeffler bacillus in addition to the ozæna bacillus. I have met with cases of this prolonged type of diphtheria which clinically resembled syphilis.

Prognosis and Course.—Such cases require very careful observation and a very guarded opinion should be expressed as to the length of time that the condition will last. Not infrequently tuberculosis or some form of chronic broncho-pneumonia may follow with fatal result. In a case of chronic diphtheria extending over seven months, which was complicated by entero-colitis during midsummer, the result was fatal.

Isolation.—The presence of the Klebs-Loeffler bacillus demands the strictest isolation from all healthy persons. The virulent nature of the Loeffler bacillus should be remembered. All children suffering with enlarged tonsils or those having adenoid vegetations should be carefully guarded against exposure to a case of this kind, as they are more prone to infection than those having healthy throats.

Treatment.—If we are dealing with a subnormal condition, the system must be built up with codliver-oil in addition to a concentrated diet, such as eggs, cereals, and broths. The most valuable drug, undoubtedly, is iron. The tincture of the chloride of iron, 10 to 30 drops, three times a day, or oftener, is very useful for its local as well as its systemic effect. I administer iron regardless of its constipating tendency, for weeks and months.

Locally, a bichloride spray or a spray of Dobell's solution can be used three or four times a day. If after several weeks of persistent treatment no benefit results, then a decided change of air, such as a trip to the seashore or to the mountains, will assist in the cure of the patient.

DIPHTHEROID.

This term we owe primarily to the French. It was introduced into the German literature by Professor Baginsky, and after him, by Escherich.

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[1] *D. Med.* Woch., May 12, 1904.

This disease is caused by an infection resulting from a series of germs, chiefly streptococci or staphylococci. It is a disease which differs entirely from diphtheria. It is not a serious disease. There are no Klebs-Loeffler bacilli present. The usual evidences of systemic infection are absent. The child shows the clinical evidences of an infection in a milder form than is usually met with in diphtheria. The prognosis is good. The treatment should be directed toward restoring the normal condition of the body, and hence the saccharated carbonate of iron given in 5 to 10-grain doses, three or four times a day, is very useful. Locally, an astringent antiseptic gargle, consisting of equal parts of Dobell's solution and of warm water, to be used every hour for gargling, or a 1 to 5000 bichloride of mercury solution is very useful. Normal salt solution is also recommended.

The nutrition of the body will be the means of restoring the functions to their normal state. It is important, therefore, to feed in regular intervals, milk, soup, broth, and eggs, if they can be assimilated. If the child is a bottle baby or a nursling at the breast, then a smaller quantity of food should be given, and if the same is not taken by the mouth then rectal alimentation will be urgently called for. It is wise to isolate each and every form of diphtheroid affection and thus prevent the possibility of the transmission of this infection.

PSEUDO OR FALSE DIPHTHERIA.

Under this general title are included all cases of pseudo-membranous or exudative inflammation of the mucous membranes in which the diphtheria bacilli are absent.

Since Loeffler, in 1889, first described a class of pseudo-membranous inflammations of the throat in which the diphtheria bacilli were absent and cocci present, it has been established that a certain portion of the inflammations of the respiratory mucous membranes, which closely resemble the less characteristic cases of diphtheria, are not due to the diphtheria bacilli, but to cocci, especially to streptococci.

It has been found that streptococci are commonly present in the throats of healthy persons, or at least in the throats of persons living in large cities, and that other forms of cocci, especially the pneumococci and staphylococci, are apt to be associated with them.

These germs seem to live in the throat without creating any disturbance there, so long as the mucous membranes are healthy; but under certain conditions, as when the mucous membrane has been made vulnerable by exposure to cold or other deleterious influences, or by the poison of scarlet fever, measles, or some other disease, the streptococci, alone, or associated with other cocci, are able to attack the mucous membrane and to cause an inflammation. This may be of any degree of intensity, from a simple inflammatory hyperæmia to an inflammation with an extensive production of pseudo-membrane or with ulceration. Such inflammations when associated with the formation of pseudo-membrane are known as pseudo-diphtheria. The exudate or pseudo-membrane in pseudo-diphtheria is usually confined to the tonsils, but other parts, such as the larynx, pharynx, and nostrils, may be invaded.

It has been found that the percentage of mortality in these cases is *far less* than in diphtheria, and that the disease is seldom, if ever, communicated to others.

Age and Mortality in False or Pseudo-diphtheria.—To compare the mortality and the communicability of false diphtheria with that of true diphtheria, 450 cases of the false were carefully investigated by sanitary inspectors detailed for this work.[1] These cases comprised 300 occurring in the fall months, and 150 occurring in the following spring. The cases were taken in consecutive order, and are believed to be average cases.

In the 450 cases investigated there were 11 deaths, or about 2 $^1/_2$ per cent. mortality. Of the 450 cases, 42 were complicated with scarlet fever, and of these 42, 4 died. In 6 of the 450 cases, measles occurred as a complication, and these all recovered. Of the 2 deaths which occurred among the adults, 1 was of a man of 70 years, who was suffering from a serious valvular lesion of the heart, and the other was a young adult female, who died of septicæmia.

The statistics gathered of the location of the disease in the true and false cases are of special interest. There were 286 of the cases examined in which the disease was entirely or chiefly confined to the larynx or bronchi, and of these 283 were in children. In the cultures of 229 of the 286 characteristic Loeffler bacilli were found, and the cases were thus proven to be true diphtheria. Of the 229 cases in which the Loeffler bacilli were found, 127 showed no pseudo-membrane or exudate above larynx, while in the remaining 62, although the larynx was mainly involved, there was also some membrane or exudate present on the tonsils or in the pharynx. In 57 out of the 286 examined, no diphtheria bacilli were found, but in 17 of these the cultures were unsatisfactory. Excluding the 17 doubtful cases, there were 40 cases of pseudo-diphtheria in which the diphtheria bacilli were certainly absent. The disease was confined to the larynx or bronchi in 27 out of 40, while more or less exudate or membrane was present on the tonsils or in the pharynx in 13.

The Proportion of Cases of Suspected Diphtheria which upon Examination Prove to be True Diphtheria.—"As soon as careful investigation had demonstrated it was possible, with proper precautions, to separate by bacteriological examination the cases of the true from those of the false diphtheria, large numbers of cases suspected to be diphtheria were examined bacteriologically. The reports from hospitals in which all cases of suspected diphtheria were examined, are of special interest as showing the proportion of cases of true to false diphtheria. The results from these hospitals are all the more valuable because they come from all parts of the various cities in which the respective hospitals were located, and hence special local conditions were not likely to greatly influence the result obtained. Thus, Baginsky, in Berlin, found the diphtheria bacilli in 120 out of 244 suspected cases; Martin, in Paris, 126 out of 200; Park, in New York, 127 out of 244; Janson, in Switzerland, in 63 out of 100, and Morse, in Boston, in 239 out of 400. Thus, from 20 to 50 per cent. of the cases sent to diphtheria hospitals did not have diphtheria.

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[1] *Bulletin* of the New York Health Department.

"If we examine the reports of examinations made under some special conditions, as during an outbreak of some contagious disease in a hospital for children, we find the results may differ in a striking manner.

"Thus, in 1889, Prudden made bacteriological examinations of 24 fatal cases of pseudo-membranous inflammation of the tonsils, pharynx, and larynx. In none of these were the Loeffler bacilli found to be present. These cases occurred in two hospitals for children in New York in which both scarlet fever and measles were at the time prevalent. During the past year we have examined the exudate from 46 fatal cases of suspected diphtheria occurring in these same institutions, and found the bacilli present in 44 of them."

If scarlet fever and measles (but not true diphtheria) were prevailing in an institution, it is evident the bacilli would be absent from the pseudo-membranes occasionally occurring in the throat as a complication of these diseases.

The Mortality in True Diphtheria and in Pseudo-diphtheria. — All observers have found the mortality far higher in those cases in which the diphtheria bacilli were present than in those in which they were absent. In true diphtheria the mortality has been found to vary from *25 to 70 per cent.*, while in pseudo-diphtheria it varies from *0 per cent. to 20 per cent.*

The death rate in cases of pseudo-diphtheria occurring in hospitals averages far higher than the death rate outside of such institutions. The reason for this is chiefly to be found in the fact that it is mainly the graver cases, especially those suffering from laryngeal obstruction, which are removed to the hospitals.

CHAPTER VII.

RUBELLA (RÖTHELN, GERMAN MEASLES, FALSE MEASLES).

RUBELLA is an exanthematous eruption simulating measles. Corlett's description of rubella is so classic that I give it word for word.[1]

"Rubella is a mild form of infection which always follows a benignant course and first appears as a general or constitutional disease, accompanied by a slight rise of temperature and slight feeling of illness. In this it conforms to the other affections of this class.

"The local manifestations, while partaking of the character of those observed in both scarlet fever and measles, are distinct, and possess an individuality which, as a rule, may be recognized by the trained eye.

"**Etiology.**—While we have no exact knowledge of the cause of the disease and in what respect the virus differs from that of other diseases to which it bears the closest resemblance, yet we do know that it is contagious, and always gives rise to a like disease: in short, conforms to the type.

"It occurs but once in the individual, from which we infer that it is self-protective, while it affords no protection to or modification of measles or scarlatina; nor has it appeared that they offer any protection against rubella. It must be remembered, moreover, that even mild forms of the various exanthemata are self-protective. The fact that the patient has had at some previous time either scarlet fever or measles, or both of these affections in a well marked degree, often leads to its recognition. Sometimes, even before its true nature has been definitely settled in the mind of the medical attendant, the disease disappears.

"Like the other exanthemata, it always appears in the form of an epidemic, which seems to bear little or no relation to epidemics of other diseases, such as scarlet fever or measles."

Bacteriology and Pathology.—Owing to the mild character of the disease, the pathological changes have not been studied. There are certain changes seen in the skin, described by Thomas. Nothing definite, however, can be stated. Bacteria in the blood of children suffering with rubella have been described by several authors; these are by no means pathognomonic of this condition.

"It sometimes occurs independently; again, two or more of the epidemic exanthemata prevail at the same time. It must be admitted that extraneous conditions of weather and possibly of sanitation predispose in a like degree to all. Though epidemics of rubella seem to occur at less frequent intervals than do those of either scarlatina or measles, there can be no doubt that very many epidemics of rubella escape recognition, and are regarded as mild or aberrant forms of one or the other of the first named affections. While the author believes, with Atkinson, that unless more exact methods are adopted in the study of the exanthemata there is still danger of endless confusion, and that the practice of relegating all mild or otherwise anomalous forms of measles or scarlatina to rubella is, as it was thirteen years ago, far too prevalent; yet the remedy lies in giving to this important group of affections a more conspicuous position than it now holds in the curriculum of clinical instruction."

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[1] For a very minute description of this disease the reader is referred to Corlett's "Treatise on the Acute Exanthemata." Published by F. A. Davis Company.

The period of incubation is usually from fifteen to eighteen days.

Symptoms and Diagnosis.—The symptoms may be so mild that they are frequently overlooked. The prodromal symptoms appear a few hours before the rash is seen. Some authors state that in the majority of cases they are wholly absent. I have frequently seen catarrhal symptoms such as coryza in addition to suffusion of the eyes, on the day previous to the eruption.

Throat symptoms, such as congestion and swelling of the tonsils and fauces, are usually seen. Cough and hoarseness may also be present. The buccal mucous membrane does not have an enanthem. Forchheimer[1] describes what he considers a characteristic enanthem in rubella which appears simultaneously with the exanthem and remains from 12 to 14 hours. Its favorite location is on the soft palate, sometimes extending to the hard palate. It consists of small discrete dark red but not dusky papules, which soon disappear, leaving no trace behind. The rest of the mouth may or may not be congested.

Sometimes there is anorexia and occasionally nausea or vomiting. J. Lewis Smith describes convulsions seen in the disease. The temperature varies between 100° and 101° F., rarely higher. The tongue is not as thickly coated as in measles, although the papillæ may be enlarged. These projecting papillæ appear on the tip of the tongue. The characteristic strawberry tongue is absent.

Sneezing may be present and coryza may be absent, or *vice versâ.*

Thierfelder[2] states that "swelling of the subauricular and superior jugular lymphatic glands may be looked upon as a constant prodromal symptom." Atkinson[3] says "enlargement of the superficial lymphatic glands of the neck may be the most striking symptom, and sometimes attracts attention several days before the beginning of the eruption."

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[1] "German Measles," Twentieth Century Practice of Medicine, New York, 1898.

[2] Thierfelder: Greifsw. Med. Beitr., B. ii, Ber., p. 14, 1864.

[3] Atkinson (loc. cit., p. 23).

Corlett[1] says "his cases show adenopathy in 96 per cent., of which the maxillary and superficial or post-cervical were the most frequently involved; next the occipital, posterior and anterior auricular; and sometimes the superficial inguinal, axillary, and the epitrochlear. In the neck the inflammation may be sufficiently severe to interfere with free movement, and in two or three instances it has given rise to marked œdema of the surrounding parts." Suppuration of the glands is never observed. The lymphatic ganglia are also involved in the regions affected. The spleen is seldom involved.

Pauline M., 6 years old, was brought to my office in an apparently good condition. I was told that the child had a rash on her chest and back, and that the temperature was 100° F. in the rectum. There was sneezing, but no cough nor bronchial symptoms. There was an enlargement of the glands on both sides of the neck along the posterior border of the sterno-mastoid muscle. The buccal mucous membrane, pharynx, and tonsils were but slightly inflamed. The conjunctivæ were of a deep pink color. The rash was scattered over the abdomen and chest and was crescentic in its arrangement, similar to that seen in measles. The highest temperature reached was 101° F., in the evening, pulse was 100, and the respiration 24. The treatment consisted in giving a mild laxative and liquid diet. Strict isolation was insisted upon. The eruption remained about three days. The child recovered without any complication.

The Eruption.—The rash is first seen on the face and scalp. It is described as "faint pinkish maculæ, at first discrete, but sometimes becoming more or less confluent within a few hours." The eruption spreads downward to the neck and upper part of the abdomen until the upper and lower extremities are covered. The palms and soles are usually associated in this general eruption. The eruption reaches its full development after one or two days. It spreads slowly and fades on the face when it is about reaching its height on the lower extremities. Hardaway believes that this dissimilarity in the appearance of the eruption is a valuable means of distinguishing rubella from measles. "The individual lesions are sometimes perceptibly elevated and vary in size from a pin-head to a small bean." They are often slightly elongated or irregularly round in shape, with an ill-defined border, and disappear completely on pressure. Unlike measles, they show no tendency to form groups, clusters, or crescents, and in some cases manifest a feebler predilection to coalesce. Sometimes, however, when confluent they extend at the periphery, coalesce, and form extensive areas, when the resemblance to scarlatina may lead to an error in diagnosis.

"Usually the plaques thus formed are found only on certain parts, while on the remaining portions of the body the eruption presents the more usual appearance. The color is always lighter than that observed in scarlet fever, and in a strong light the slight elevations which correspond to the original lesions may be discerned. Further, the eruption is fairly uniform in color and may be described as of a faded rose, or pink tint, never, in my experience, presenting the fiery red of scarlatina nor the dusky, bluish red of measles."

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[1] Corlett, "A Treatise on the Acute Infectious Exanthemata," p. 356.

Subjective Symptoms.—These are usually so mild that children do not complain. I have seen cases of rubella in the Kaiser and Kaiserin Frederick Hospital, in Berlin, while making rounds with Professor Baginsky, which were of a very mild nature and in which hardly any subjective symptoms were complained of.

The Fever.—A peculiarity of this condition is that the fever does not correspond with the eruption, in intensity. Von Nymann studied 119 cases of rubella. He found that 58 cases showed no rise in temperature. In the remaining 61 cases the temperature was as follows:—

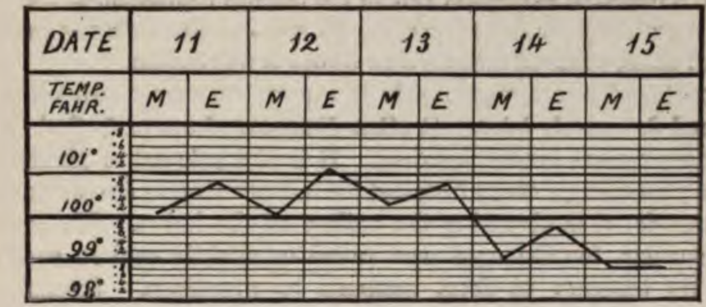

Fig. 197.—Temperature Chart. Case of Rubella. (Original.)

In 39 cases the highest record was 100.4° F. (38.0° C.)
In 14 cases the highest record was 101.3° F. (38.5° C.)
In 6 cases the highest record was 102.2° F. (39.0° C.)
In 2 cases the highest record was 103.1° F. (39.5° C.)

Fever never remains more than four days *unless some complication exists.* The pulse and respiration do not show much change, but usually correspond with the temperature. Sometimes a slight albuminuria is present.

Desquamation.—A general desquamation is absent. Just as the rash spreads from place to place and is regional in character, so also is the desquamation regional. There is therefore no distinct stage of desquamation that can be applied to the disease as a whole.

Differential Diagnosis.—The following distinctive points are taken from Corlett:—

"First.—That rubella is sometimes feebly contagious, while measles is always violently contagious.

"Second.—The prodromal stage is always short and quite insignificant in rubella, while in measles it continues from three to four days.

"Third.—In measles the prodromal stage is usually accompanied by marked constitutional symptoms, with catarrh of the upper air passages, lacrymation, photophobia, and a more or less characteristic eruption in the mouth, which appears from twelve to forty-eight hours before the cutaneous exanthem. In rubella no characteristic prodromata are observed, and only at the beginning of the eruptive stage is there usually a slight hyperæmia of the conjunctivæ, of the faucial mucous membrane, and rarely of the upper air passages. On the soft palate and uvula there is sometimes a punctate or faint macular enanthem, which by some is considered distinctive. Even in mild cases of measles the disturbance of the mucous membranes is more severe than in severe cases of rubella, and there is always, so far as I have observed, a bluish or skim-milk tint to the mucous membrane of the mouth, which I have never found in rubella. In rubella, sore throat is present in nearly all cases, while in measles sore throat is uncommon.

"Fourth.—The eruption in rubella appears most frequently on the first and second day, rarely later. It often disappears from parts first attacked before other regions become involved. It is of a pale red or pinkish color, very rarely assuming a dusky tint, and the individual spots are surrounded by a faint areola, thus obscuring the outline of the lesion. The spots are papulo-macular, for the most part round or slightly oval in shape, and present no tendency to form crescents or groupings. Sometimes by coalescing they unite to form extensive areas, which in all cases, either at the periphery or on more remote parts, are associated with the discrete, small macules which give character to the eruption. The rash rarely lasts longer than three days, and most frequently it disappears on the upper part of the body on the second; while in measles the eruption almost always appears on the morning of the fourth day, sometimes on the third, and rarely earlier. In measles the color is of a dark or purplish red, and the lesions are well defined, with normal skin intervening. They enlarge at the periphery and show a marked tendency to form groups and crescents. These are especially marked on the face, neck, and upper part of the trunk. In all cases the individual lesions are larger than in rubella; so that the whole surface of the body may be involved at the same time, consequently, it remains longer than that of rubella, lasting from four to five days, or longer, when defervescence begins.

"Fifth.—In rubella the superficial lymphatic glands of the neck are nearly always involved, being swollen and sometimes painful; while in measles marked or painful enlargement of the glands of the neck is decidedly uncommon.

"Sixth.—In rubella the temperature may be only slightly above the normal at any time during the course of the disease, and it rarely exceeds

102° F. (38.8° C.). Nor is the temperature curve in any way characteristic of the affection. Further, it is usually of short duration and rarely continues beyond the second or third day. In measles fever is always present and the temperature is sometimes high. There is an initial rise of temperature during the prodromal stage, which usually subsides, returning just previous to the appearance of the eruption, and attaining its maximum at the height of the efflorescence. The fever may continue until the seventh or eighth day.

"Seventh.—Rubella is seldom accompanied by complications or followed by sequelæ, while in measles complications are common and constitute the most serious feature of the disease."

In studying the above we can readily see that measles is very frequently mistaken for rubella. Scarlet fever has a small punctate rash very uniform in character. The temperature, and the characteristic throat and tongue will usually differentiate this condition.

Syphilis is frequently mistaken for rubella, but the absence of the characteristic initial lesion will aid in establishing the true diagnosis. Before making a positive diagnosis we should see that our patient is not suffering from a drug eruption.

Complications.—These are rarely seen. The disease is so benign that it rarely leaves any after-effects. Recurring rashes have been described by various authors, hence, a *relapse* is possible. This second rash does not differ in character from the first. The contagious nature of this condition has been well established. Hatfield reports[1] that of 196 children in an asylum, 110 were affected. Corlett believes that it is as contagious as measles, but the contagium retains its vitality longer and hence resembles scarlatina. The infectious nature of this disease has been studied by Edwards, who found that 75 per cent. of cases in an epidemic in Philadelphia could be traced to infection from the bunks of ships.

Course.—Rubella runs a mild course. Cases seen by me during an epidemic in the winter of 1903-1904 remained ill about three to four days, rarely five days. Some authors state that children with rubella are ill one and two weeks.

Prognosis.—This is always good. With good sanitary surroundings, aided by careful diet, recovery always takes place.

Treatment.—A child with rubella should be put to bed and kept confined until all evidence of eruption has disappeared. A liquid diet should be prescribed. The gastro-intestinal tract must be watched; the bowels and kidneys assisted if necessary.

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[1] Chicago Medical Examiner, August, 1881.

CHAPTER VIII.

MEASLES (MORBILLI, RUBEOLA).

MEASLES is an acute eruptive disease associated with fever. It is caused by the invasion of a specific micro-organism the character of which has not yet been definitely determined.

Etiology.—Measles is a contagious and to a less extent an infectious disease. It is usually communicated direct from person to person. Intermediate contagion is comparatively rare. Contagion is possible three or four days before the rash appears on the skin, and continues until desquamation has ceased. Children differ as to their susceptibility, some contracting the disease by very short exposure, while others require a longer and more intimate contact.

The disease can be more readily conveyed in poorly ventilated or crowded apartments, schools, and kindergartens, where many children are intimately associated.

The disease is characterized by coryza, and a congestive condition of the conjunctivæ, with more or less catarrh of the respiratory tract, accompanied by an exanthem. This disease is always accompanied by high fever. One attack usually confers immunity. The mortality is usually low in robust children. It is as high as 30 to 40 per cent. in rickety and bottle-fed children. The danger is not so much from the measles as it is from the complications, notably broncho-pneumonia and laryngeal croup.

Period of Incubation.—The period of incubation ranges between nine and fourteen days, the average being eleven days. Some authors[1] give eighteen to twenty-one days as the period of incubation when measles occurs a second time.

Bacteriology.—In the blood of fatal cases, the staphylococcus pyogenes albus and the streptococcus pyogenes are found. Claisse[2] describes an acute septicæmia found in measles in very young children. In these cases the streptococcus was invariably found.

Pathology.—In a study of the early mucous lesions in the mouth Slawyk found that the epithelial cells were thickened and in some instances had undergone fatty degeneration. No specific micro-organism has been found in the lesions. Frequently there is a tendency to the formation

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[1] Graham: Article on "Measles;" Morrow's "System of Dermatology," 1894, vol. iii.

[2] Revue de Med., May 10, 1893.

TABLE NO. 86—*Deaths from Measles in Children Under 15 Years—Old City of New York.*

		Total.	0 Year.	1 Year.	2 Years	3 Years.	4 Years.	Under 5 Yrs.	5-10 Years.	10-15 Years.
1890	Males	381	121	139	59	35	11	365	16	
	Females	343	99	141	51	23	13	327	15	1
1891	Males	311	82	116	42	28	25	293	18	
	Females	346	94	138	59	26	17	334	12	
1892	Males	448	151	166	61	33	19	430	17	1
	Females	410	111	150	66	32	24	383	27	
1893	Males	198	57	85	27	14	6	189	9	
	Females	191	54	67	37	17	5	180	10	1
1894	Males	297	96	108	37	28	8	277	19	1
	Females	282	88	94	42	31	12	267	15	
1895	Males	371	84	167	62	31	12	356	13	2
	Females	417	108	157	72	45	15	397	19	1
1896	Males	352	99	119	69	30	19	336	15	1
	Females	353	88	133	77	31	8	337	15	1
1897	Males	191	53	80	30	17	5	185	6	
	Females	196	55	79	28	17	5	184	10	2
1898	Males	252	76	112	39	11	8	246	6	
	Females	190	48	88	28	13	8	185	5	
1899	Males	202	60	81	27	12	6	186	15	1
	Females	176	35	90	27	10	9	171	5	
1900	Males	237	60	95	40	16	11	222	12	3
	Females	227	56	101	26	17	12	212	14	1
1901	Males	149	37	53	26	12	10	138	11	
	Females	118	24	48	25	12	3	112	6	

of ulcers, which extends to the deeper parts. Unna called attention to the thrombosis of superficial vessels of the skin in a severe type of measles resembling smallpox. When gangrene existed streptococci were always present. Corneil and Babes report a special form of pneumonia beginning as an interstitial pneumonia and later giving rise to a fibrinous effusion into the alveoli. It involves the lymphatic system, the interlobular and interalveolar tissue. The toxic effect of the measles virus resembles pathological changes noted in diphtheria. They can be found in the central nervous system. No doubt the toxin generated by a specific organism similar to that of the Loeffler bacillus found in diphtheria causes the degenerative changes.

Symptoms.—*Prodromal Stage or Period of Invasion:* The first symptoms are those of an ordinary coryza, sneezing, dry cough, and watering of the eyes (lacrymation), with photophobia. Moderate fever, temperature from 101° to 102° F., rarely higher during the first day. There is sometimes vomiting.

This condition lasts about three days and is followed by the characteristic eruption. This eruption is first seen on the face or neck on the morning of the fourth day. Very young infants show extreme irritability and restlessness. The tongue is covered with a white fur. The papillæ are red and swollen. They are not as conspicuous as in scarlet fever. There is intense dryness, and thirst, with marked anorexia, and usually constipation.

The temperature shows great variability. Wunderlich, Thomas and von Jurgensen, who have studied the temperature exhaustively, state that it cannot be considered characteristic, owing to its frequent variations. The temperature after having reached 102° F. or even 104° F. will on the second day of the disease drop to nearly normal. There is usually a morning remission to the temperature. The temperature in a characteristic case is sometimes deceptive, so that after three or four days of illness, there may be a sudden activity of all symptoms with a rise of temperature. The temperature frequently reaches 105° F.

Early Symptoms of Measles.—The absence of the thick epidermic covering which masks the first pathological manifestations in the skin (exanthem) is more readily seen on the delicate mucous surfaces (enanthem).

The enanthem in measles has long been known. It has been studied by Willan, in 1806; by Heim, in 1812; in Dunglison's "Cyclopædia of Practical Medicine," in 1854; by Trousseau, in 1866. Niemeyer's "Practice of Medicine," 1876, vol. ii, p. 528, mentions Rehn, who studied an eruption in the cheek, gums, lips, and fauces. Rilliet and Barthez, 1854, and Monti, in 1873, devote considerable attention to the prodromal enanthem of measles.

Flindt, of Denmark, describes it at length in the "Sundheds-collegium," as follows:—

"First day of the fever: A slight, diffuse erythema of the throat.

"Second day of the fever: A fairly dark redness without marked œdema of posterior pharyngo-palatine arch and tonsils, which on the anterior palatine arch (arcus glosso-palatinus) and velum palati is somewhat less deep in color and of an irregularly diffused or mottled appearance. On the evening of the second day of the fever the mucous surfaces of the tonsils, and the posterior palatine arch, have undergone but little or no change, appearing as a uniformly red erythema, with slight œdema. On the anterior surface of the soft palate, and the posterior part of the hard palate, as well as occasionally on the remaining normal mucous surfaces, a distinct enanthema appears. The lesions are round or irregular in shape, of a bright red color, having an ill defined margin, with little or no elevation at this time above the surrounding surface. They range from a pin-head to a lentil in size, and occur singly, or are scattered irregularly over the surface. In places there is a tendency for the lesions to cluster in groups and to become blended.

"They acquire a peculiar appearance on account of numerous small, white glistening points (simulating minute vesicles), which occupy the middle of the small red macules. These manifestations in the macules are irregularly grouped. One can see and feel the minute vesicles elevated above the surrounding areas. The palpebral conjunctiva is hyperæmic in its entire extent. Besides the reticular and macular reddening of the conjunctiva, which is due to the disposition of the conjunctival vessels, there are also small, glistening, miliary elevations similar to the elevations in the palate.

"Third day of the fever: The mucous surfaces of the buccal cavity, which up to this time have been only slightly hyperæmic, are now found to be invaded by the lesions previously described. These latter are strongly marked over the entire anterior surface of the velum palati, the glosso-palatine arch, and usually also over the contiguous two-thirds of the hard palate. The red spots are sometimes very numerous, at other times isolated, and again, by blending, they form irregular figures of a stronger red than previously seen. Here and there a faint appearance of the previously described vesicle-like formations is seen projecting above the surrounding surface. On the other hand they may also be found on the apparently normal mucous membrane. Similarly grouped spots with whitish vesicles now also appear on the inner surface of the cheeks, especially on the part opposite the juxtaposition of the upper and lower molar teeth.

"As a rule, the gums and the inner surface of the lips retain their normal color, or at most are only slightly hyperæmic. It is, indeed, seldom that the eruption appears on these parts. The tonsils and both pharyngo-palatine arches still remain red.

"The palpebral conjunctiva retains its deep red color, but no spots are visible, excepting the minute vesicles previously described. At this time the eruption breaks forth on the skin. On the evening of the third day there is little or no change perceptible.

"Fourth day of the fever: On the palate and inner surface of the cheeks the spots stand out prominently, while in many places there is a tendency to merge by enlargement of the individual lesions, and on the surfaces last invaded they are more copious than ever. The conjunctival exanthem is now disappearing. On the evening of this day there is no change noted.

"Fifth day of the fever: The exanthem in the buccal cavity is more marked than heretofore. Frequently at this time there appear faint-reddish spots on the mucous surfaces of the lips, even extending to the exposed cutaneous margin. On the gums they are seldom present and never distinct. The hyperæmia of the posterior fauces remains unchanged. The skin exanthem begins to fade, and the temperature falls.

"Sixth day of the fever: The exanthem of the mucous surfaces is no longer visible, except a slight diffuse redness of the palate and the inner surface of the cheeks. Fever ends."

This characteristic enanthem is seldom absent. Slawyk[1] found it present in 90 per cent. of all cases examined.

Koplik described these symptoms[2] and to him belongs the credit of having popularized the enanthem. It is generally known as Koplik's sign. The spots are best seen on the inside of the cheeks opposite the molar teeth, although I have seen them very clearly defined on the mucous membrane of the upper lip corresponding to the incisors.

The patient must be examined in a strong sunlight or with a good electric light. A yellow gaslight, for instance, is very unsatisfactory.

Differential Value of this Sign.—This enanthem is of great value in differentiating measles from other exanthemata, notably, however, from antitoxin rashes, drug eruptions, and eruptions associated with toxæmia from gastric fevers.

Period of Efflorescence (Eruptive Stage).—The eruption usually appears on the fourth day of the disease. Sometimes it appears as early as the third and sometimes as late as the fifth day. The first spots appear on the forehead or the temples, behind the ears, and on the sides of the neck. Later, spots appear about the eyes, mouth, and chin. When the rash is at its height then a *crescentic* character, first described by Willan, will be noticed. The constitutional disturbances increase in severity. The cough is more pronounced and there is a decided interference with the respiration. Nose bleed is quite frequent. Constipation is usually followed by very loose bowels.

The Rash.—The rash is of a dark red, sometimes a purplish color, of a round, oval or irregular shape. The skin between the rash remains intact, although the face has a puffy œdematous appearance. The eruption extends over the trunk and extremities, including the palms and soles, the arms and legs, the forearms and legs being the last to become affected.

When the rash reaches its height the constitutional symptoms subside. It is not infrequent to see a *normal temperature two days after the rash* has *completely covered the body.* In some instances there is a crisis, although the usual rule is for the temperature to fall gradually by lysis. A subnormal temperature frequently follows and accompanies the period of convalescence and until the patient is normal.

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[1] Slawyk: Deut. med. Woch., April 28, 1898.

[2] *Archives* of Pediatrics, December, 1896; Medical Record, 1898.

The catarrhal symptoms continue to increase in severity with the development of the rash.

There are moist râles heard on auscultation. The sputum as well as the nasal discharge become sero-purulent. A bronchitis or a pneumonia should be suspected, if the respiration is exaggerated. The *pulse-respiration ratio will be found of great value in diagnosing latent pneumonia.* The urine will show the excess of urates and sometimes transitory albuminuria or hyaline casts may be found. The diazo reaction is sometimes noted, but it does not teach us anything of value in either the diagnosis or prognosis. This stage of the disease rarely lasts more than from four to six days.

Stage of Desquamation or Convalescent Period.—The eruption on the skin of the face, neck, and upper part of the chest fades and there is a slight branny desquamation. This is less marked than in scarlet fever, and is so fine on the trunk and extremities that it may be unobserved. *It is best seen on the sides of the nose, temples and chin. Large, flaky scales are rarely met with in measles.* After the eruption disappears, a certain amount of pigment remains for a week or two where the rash existed.

Atypical or Anomalous Conditions.—Certain symptoms of normal measles vary in different epidemics, although the majority of cases present distinct clinical features. Predisposing factors, such as rickets and scurvy, possibly tuberculosis, will frequently alter the type of the disease or modify the symptoms. Edgar[1] reports an epidemic of 423 cases in which 123 adhered to the regular type.

Mild Forms.—Measles may be present without catarrhal symptoms. In such cases fever may be slight or absent. In other cases the catarrhal symptoms are severe *while the cutaneous exanthem is almost wholly absent* (morbilli sine morbillis). Such cases might readily escape notice unless they partake of a series during an epidemic, in which both the mild and the severe type are found.

Relapsing Form or Second Attack.—A relapse is said to occur in rare instances, after the exanthem has disappeared. When the second rash appears there is a return of fever and also the other constitutional symptoms. Recurring measles is often a very serious matter, owing to the already weakened state, resulting from the first invasion.

Corlett doubts the so-called relapses and believes that they are due to a direct reintoxication by the specific virus.

Severe or Malignant Forms.—Malignant measles is that form in which there is a very high fever, rapid pulse, labored breathing, and great prostration. The fatal issue most frequently occurs on the second day of the exanthem. We frequently meet with a typhoidal or a toxic form in which the symptoms are of a most malignant character. The mouth becomes parched and the tongue brown and dry, resembling a typical typhoidal condition.

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[1] Can. Med. Record, December, 1892.

The bowels are loose and the quantity of urine diminished. Convulsions resulting from the general toxæmia are very common. It is usually fatal and rarely ends in recovery. Where there is severe respiratory disturbance, with difficult breathing, it is called the *suffocative form*. In this form we have principally cough and expectoration with severe dyspnœa.

The patient is cyanotic. Mucous râles are heard early in the disease, and it not infrequently ends in a broncho-pneumonia.

Hæmorrhagic forms, known as the black measles, are frequently described. The mild form of hæmorrhagic measles has been described by various authors. Edgar reports 200 cases out of 423, or 47 per cent. of the hæmorrhagic form. Holt found it in 5 per cent. of his cases. The cutaneous exanthem assumes a dark bluish or purplish tint, which gradually deep-

TABLE No. 87.—*Showing 503 Cases of Measles and Complications, Treated in the Riverside Hospital, New York City, During the Months of January to July, Inclusive.*

	No. of Cases.		Uncomplicated Measles.		Measles and Diphtheria.		Measles and Pneumonia.		Measles, Scarlet Fever and Diphtheria.		Measles and Scarlet Fever.	
1904	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Jan.	34	4	31	1	2	2	1	1				
Feb.	70	8	62	1	7	6	1	1				
Mar.	133	14	111	2	9	6	4	4	2	1	7	1
Apr.	103	15	81	0	8	8	10	7	1	0		
May	106	16	77	2	13	4	13	8	1	1	2	1
June	37	8	23	0	7	3	7	5				
July	20	5	12	0	3	1	5	4				
Total Cases	503		400		49		41		4		9	
Total *Deaths*		70		6		30		30		2		2

ens as the process continues, to a bluish-black color. Frequently the whole body shows a tendency to bleed. Thus the mucous surfaces are implicated, giving rise to epistaxis, bleeding from the gums, dysentery stools and hæmorrhages from the genito-urinary tract. Where a tendency to hæmorrhage exists, as in hæmophilic subjects (bleeders), they are especially predisposed to the hæmorrhagic form.

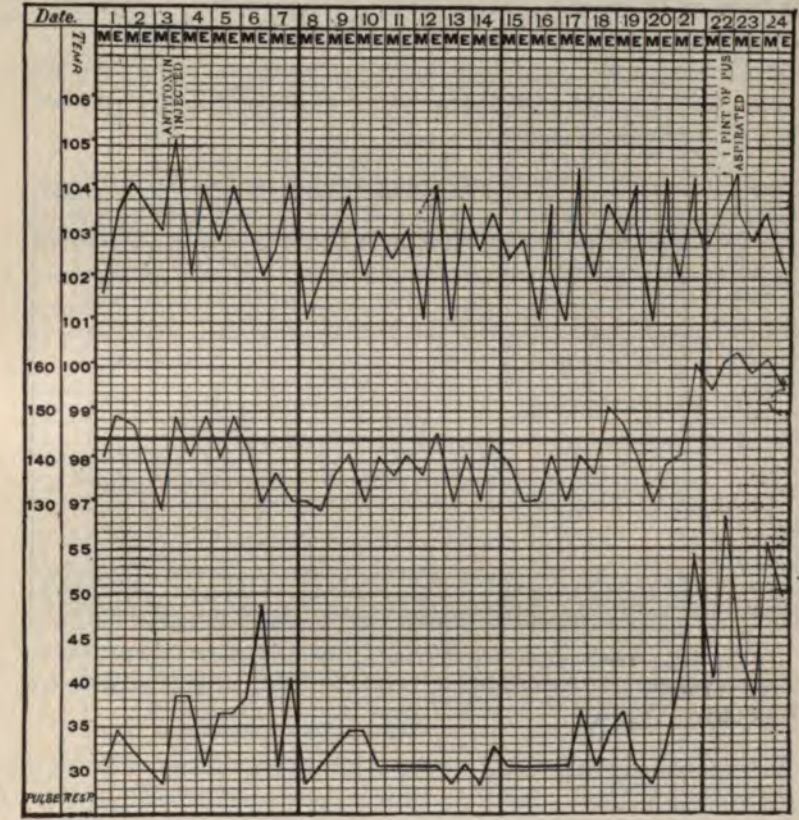

Fig. 198.—A Case of Malignant Measles, complicated by Diphtheria and ending with Empyema. Male child, 3 years old. Septic from beginning. Fatal termination. Seen in my service at Riverside Hospital, New York City. (Original.)

Complications.—*Pulmonary:* There seems to be a predisposition to pulmonary disease, commencing with a bronchial catarrh, especially in those children with feeble resisting power. The inflammatory condition extends into the smaller ramifications of the bronchial tubes, causing capillary bronchitis. When this occurs it should be viewed with alarm. The child shows dyspnœa and adynamic symptoms, owing to difficult oxygenation.

The Larynx.—One of the most frequent and fatal complications met with in children is laryngitis. This may be:—

(*a*) *Spasmodic.*
(*b*) *Phlegmonous.*
(*c*) *Membranous.*

The last named complication is the one most frequently met with, especially in institutions. It is most common during the eruptive stage as early as the third or fourth day. The symptoms are the same as those met with in laryngeal diphtheria accompanied by stenosis of the larynx.

The Klebs-Loeffler bacillus is sometimes found on bacteriological examination of the pseudo-membrane. It can be found in 6 to 10 per cent. of all cases of membranous laryngitis.

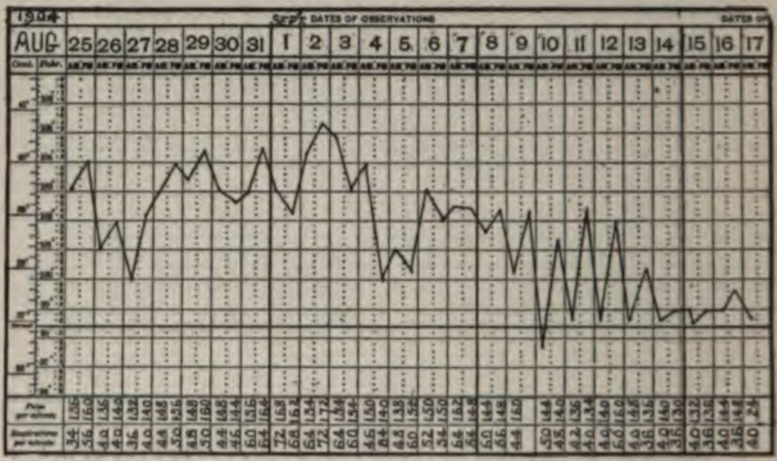

Fig. 199.—Temperature Chart from a Case of Measles Complicated by Broncho-pneumonia. Seen during my service at the Riverside Hospital, New York City. (Original.)

Broncho-pneumonia.—This is the most frequent and the most fatal complication of measles. Houl[1] found it in one-fifth of all of his cases. In the Nursery and Child's Hospital of New York, Holt observed it in 40 per cent. of all cases. This infection can invariably be traced to the presence of various organisms of which the pneumococcus of Friedländer, and the micrococcus of Fränkel play a conspicuous rôle.

There is marked retraction of the chest in addition to the usual signs of pneumonia. The physical examination shows widely disseminated subcrepitant râles which soon give way to definite resonance, bronchial breathing, and fine crepitations. In young children its onset is acute, with rapid pulmonary congestion, and it usually terminates fatally within two or three days. When the condition extends over a more subacute course, it may lead to caseous pneumonia or pulmonary tuberculosis.

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[1] Wien. klin. Rund., 1897, vol. xi, p. 833.

Case I. Kate A., aged twenty-one months. Child was admitted to the Riverside Hospital August 25, 1904, in fairly good condition, with temperature 104° F., pulse 136, respiration 36. Sick since August 22d. Child had a moderately severe cough on admission. On August 26th cough increased in severity, breathing short, rapid and labored.

Physical examination showed only a few coarse râles at upper part of chest posteriorly, with slight dullness, but no bronchial breathing.

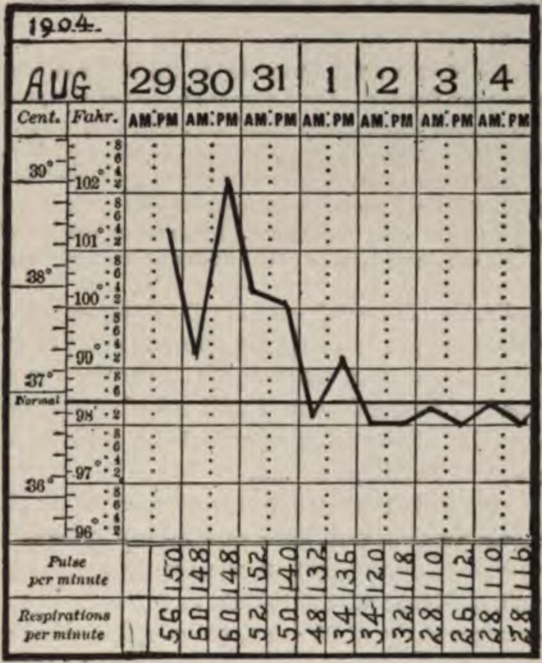

Fig. 200.—Temperature Chart from a Case of Measles Complicated by Broncho-pneumonia. Seen during my service at the Riverside Hospital, New York City. (Original.)[1]

Well-marked dullness over the right base posteriorly, with bronchial voice and breathing. Left base behind gave slight dullness with many coarse râles. No bronchial breathing.

On August 28th, pleuritic friction sounds over right base posteriorly.

On August 31st, percussion gave marked dullness, almost flatness over this area, extending slightly above the inferior angle of right scapula. Over this area, marked bronchial voice and breathing.

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[1] I am indebted to Drs. Alfred Helgeson, Bruno Horwicz, and Wm. Ogden Lord for clinical histories, charts, and statistics.

On September 1st, bloody serum obtained upon aspiration.

On September 3d, serum obtained by aspiration, bloody with slight turbidity. General condition continued the same up to September 9th. On this day a drop in the temperature from 102° to 97.6° F. occurred. Child appeared brighter, slept well and has a good appetite.

During the last two days, fluctuations in temperature have occurred, ranging from 98° to 101° F. (evening rise).

This fluctuation of temperature continued up to September 14th. On this date there was an evening rise to 99° F. only, and since then, the highest rise has been $99^{3}/_{5}$° F. The pulse has improved much in quality. Respirations have gradually diminished in frequency. The child was aspirated on the 13th, but no pus or serum was obtained. Dullness was diminished over right base posteriorly and bronchial breathing was present only over a small area at base of right lung. Child at present sits up, has good appetite, and sleeps well.

Case II. L. Z., age eight months. Admitted to the Riverside Hospital on August 29th, having been ill since the 21st. Upon admission showed characteristic symptoms of broncho-pneumonia with temperature 101.4° F., pulse, 150; respiration, 56. Upon examination, dullness was present over right base behind, with bronchial voice and breathing. Many coarse râles were heard over both lungs behind as well as in front. There was a pleuritic friction sound over the consolidated area. No signs of effusion. Child improved rapidly, and upon September 3d, the bronchial breathing had disappeared and only signs were coarse râles over both bases behind. Recovery.

Otitis Complicating Measles.[1]—A very frequent sequela is acute otitis. If, after several days of apparent convalescence the child is irritable, restless at night and feverish, and cries continuously, a careful examination of the ears should be made. As a rule our attention is first directed to this condition after the cavity of the middle ear is filled with the discharge, and there is a spontaneous discharge of pus.

Siegfried Weiss[2] calls attention to the method of prophylaxis in this condition. He believes that with good care we can prevent and abort this complication. Tobeitz believes that in measles we are dealing with a primary enanthematous disease of the middle ear.

In a post-mortem study of 95 cases, pathological changes affecting the ear showed the destructive tendency due to the disease itself.

Tobeitz found that 86 per cent. of fatal cases of measles showed ear complications. Bezold in a study of 18 fatal cases of measles noted ear disease in 17, or about 95 per cent. Weiss studied 112 cases in which there were ear complications, and after careful prophylactic treatment he had only 6.6 per cent. of ear complications. Weiss's prophylactic method consists in applying a 1 per cent. yellow precipitate ointment on a sterile swab to the nostrils. By this method he removes the dried and fluid secretions from the nose mechanically. Another method of Weiss' consists in allowing 1 or 2 drops of $^{1}/_{2}$ per cent. nitrate of silver solution to drop into the nostril. In this manner he believes we can destroy the specific infectious material. Hayek has long advocated this method in the treatment of chronic rhinitis in children. In using the salve or the silver nitrate solution Weiss found that if it was applied three or four times a day, the percentage of complications was greatly reduced.

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[1] Read chapter on "Otitis."

[2] Wiener Medicinische Wochenschrift, No. 52, 1900.

TABLE NO. 88.—*Measles Statistics Showing Ear Complications, Riverside Hospital.*

1904.	Number of Cases.	Measles and Otitis.
January	31	6
February	74	11
March	127	10
April	101	14
Total	333	41

Empyema.—Empyema is occasionally met with during the course of measles. As there seems to be a decided tendency to suppurative formations, it is well to inspect the thorax and be sure that we can exclude empyema. This should be borne in mind if cough exists associated with fever. I have seen empyema complicating measles in about 2 per cent. of my cases. When the exploratory puncture shows pus the treatment is the same as that given in the chapter on "Empyema."

The Eyes.—Severe inflammatory and destructive changes are met with in measles. Abscesses of the conjunctiva or keratitis, resulting in ulceration of the cornea, are sometimes seen. In other cases it may extend to the antrum or, if the mastoid cells are involved, it can result in meningitis, cerebral abscess, or pyæmia. In very young children the petromastoid suture, which at this time is still patent, allows free access of pus into the cranial cavity from the middle ear. Not infrequently this condition leads to actual deafness.

Immunity.—One attack of measles usually confers immunity for life. Second attacks are, however, possible, and third attacks have also been reported as instances of rare conditions.

Measles is rarely seen in infants under 1 year. Mayr observed that of 10 nurslings exposed to measles, only one contracted the disease. I have rarely met with infectious diseases in healthy breast-fed infants. *There seems to be some antitoxic property conveyed to the nursing infant through the serum contained in the breast-milk of its mother.*

At the Riverside Hospital I have seen nursing infants, in the measles wards, that had been exposed and did not contract the disease.

Immunity can be conveyed by a mother who has had measles, through her milk, but how long this immunity lasts remains still to be investigated.

Diagnosis.—An ordinary cold with coryza, as met with in influenza, is sometimes confusing. Mistakes will occur unless we are careful to note *the enanthem* which is absent in influenza. The rise of temperature is less marked in influenza than in measles.

The diazo reaction is sometimes observed in cases of measles. By its presence we cannot, however, diagnose measles.

Drug Eruptions.—Some eruptions resembling measles are caused by quinine and antipyrin. The internal use of chloral is sometimes followed by an eruption. Cubebs and copaiba give an eruption simulating measles.[1]

Bites of insects, especially bedbugs, fleas, and mosquitoes, sometimes produce an eruption which resembles measles. As there is no febrile disturbance or any enanthem the differential diagnosis is easily made. The injection of antitoxin and antistreptococcic serum sometimes produces an eruption which is morbilliform in character.

Course.—As a rule three weeks should elapse before a case of measles is permitted to return to healthy children. The quarantine should be extended over this length of time. This applies to institutions as well as to private families. Isolation should be continued if a case suffers from any complication associated with the primary measles. In other words, measles otitis, measles vaginitis, or any other complication, requires isolation.

Prognosis.—When reasonable care is taken, then this is one of the least fatal of infectious diseases. The vital point consists in guarding the patient against unnecessary exposures and attending to all functional disturbances. With proper attention to the diet and symptomatic treatment when necessary, there should be little or no trouble experienced. If the fever declines after the full development of the exanthem, the prognosis is good.

If croup and diphtheria complicate measles, then the prognosis is always grave. Broncho-pneumonia is usually fatal in one-third to one-half of all cases. Sometimes a broncho-pneumonia will be followed by tuberculosis. Diarrhœa with or without bloody stools should always be looked upon as a serious complication.

Treatment.—In the treatment of measles certain rules should invariably be followed:—

(a) Hygienic.

(b) Dietetic.

(c) Medicinal.

Hygienic Treatment.—The temperature of the room should always be uniform, no less than 68° F. and never more than 74° F. Modern clinicians assert that the former method in vogue, of bundling up the body and keeping the air of the room very hot, produces a certain amount of susceptibility to respiratory diseases. In this manner we invite complications rather than prevent them. The body of the child may be sponged with tepid or warm water, and fresh linen can be given every day.

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[1] P. A. Morrow: "Drug Eruptions," New York, 1887.

Overheated rooms cause more trouble during treatment of respiratory affections than any other factor.

Light of the Room.—Careful observers have noted that the light in the room has absolutely nothing to do with the eyes. Owing to the inflammatory state of the eyes, there is a normal photophobic condition. No one would think of putting a child in the beginning of measles in a glaring sunlight, but rather with its back to the light. At the measles pavilion in Berlin, under the supervision of Professor Baginsky, the hygienic conditions are perfect. Plenty of fresh air is admitted and also light. I have frequently had the pleasure of making rounds in the wards of this pavilion with Professor Baginsky, and noted the above-named conditions. We do not darken the windows in the measles wards at the Riverside Hospital of New York City, and the hygienic conditions regarding fresh air and fresh linen have been excellent during my term of service there.

Dietetic Treatment.—We must not forget that in all febrile conditions the digestive function is impaired. The diet must be so regulated that there is proper assimilation. If subnormal conditions prevail, we must order a smaller quantity of food and allow a longer interval between feedings.

A baby receiving pure milk should receive one-half milk and one-half oatmeal water, and if it has been fed every three hours when in good health, then it is wise to try to feed every four or five hours during the febrile stage of measles. An important point to remember is that liquids are an important part of the treatment. Soups, acidulated waters, and carbonated waters are grateful and indicated. Orangeade and lemonade are grateful, especially to relieve thirst. If the child is older and has been fed on solid food when in health, then all solids should be discontinued and liquid food substituted. Water should be given in large quantities.

Medicinal Treatment.—If the eruption is tardy in appearing then a mustard foot-bath, using a tablespoonful of mustard in a foot-tub of warm water, 100° F., and adding warm water gradually until the temperature is about 105° F., will frequently hasten the appearance of the rash. This is as hot as the child can stand it for a few minutes. If there is a general depression of the vital powers, then give *spir. mindererus*, a teaspoonful every hour, until perspiration is active. This will also frequently hasten the appearance of the rash. One of my favorite drugs is tincture of aconite, in 1-drop doses, if the fever is very high.

Pneumonia requires the same care and treatment as if it were not a complication or a sequela to this disease. (See chapter on "Pneumonia.")

Diphtheria calls for the same treatment as if it was not associated with measles.

Immunity from Diphtheria.—An injection of 300 to 500 antitoxin units will confer immunity from diphtheria in a case of measles.

The urine must be frequently examined for a possible nephritis and treated accordingly.

Convulsions frequently usher in the disease and should be very carefully attended by rest, sinapisms, enemata of chloral, and possibly a few leeches to the neck.

Epistaxis is usually an early but passing symptom, but if persistent, it should be treated on general principles and the cause looked into. The congestion during an attack of measles has frequently excited an otherwise quiet polypus to activity and caused alarming hæmorrhages.

For the relief of the cough I usually give:—

℞ Ammon. bromid	℈ij		3.00
Syr. liquorit	℥j	or	25.00
Decoct. althæ	ad ℥ij		50.00

M. Teaspoonful every hour, for a child 1 year old, until relieved.

For a child 2 years old:—

℞ Codeine	2 grains
Sacch. alb.	1 1/2 drachms

M. Divide in chart No. X. Sig.: One powder every two hours until cough is relieved.

Summary of Treatment.—Give the child excellent hygiene—fresh air—protect the body with clean linen. Guard against draughts. Isolate the patient.

Do not give solid food; liquid diet only, soups, broths, milk, buttermilk if tolerated, etc.

Do not give useless drugs. Treat symptoms, such as hyperpyrexia, constipation, suppression of urine, and assist the emunctories. The greatest part of the treatment is the management of convalescence—codliver-oil, iron, Fellows' compound syrup of hypophosphites, malt preparations, cereals, butter, eggs, and cream; meat sparingly; all green vegetables; oranges and lemons.

Health can be restored by cautious management during the stage of convalescence. When cough remains and symptoms point to the beginning of tuberculosis, we must not lose sight of the fact that more can be accomplished by climatic treatment—out of doors, in the country—than by indoor treatment. Complete change of air, to a more even climate like Denver, Colo., New Mexico, or Florida, will frequently restore the lungs to their normal condition.

CHAPTER IX.

SCARLET FEVER (SCARLATINA).

SCARLET fever is an acute infectious, specific and contagious disease. The infection exists from the earliest symptoms and continues long after convalescence has been established. If a child has been exposed to scarlet fever, it should not be considered out of danger until eight or ten days have passed, and then only if there is no fever or throat manifestations visible. This disease is usually ushered in by vomiting and sore throat, accompanied by fever. If the child is old enough it will complain of headaches.

The pulse-rate will be accelerated, and there is usually on the second day a distinct eruption visible. This disease presents several types: the mildest form, known as *Scarlatina Simplex* or the benign form, and the most malignant type, *Scarlatina Maligna,* called by the French "Foudroyante."

There are a great many varieties between the two types just mentioned, so that any sharp differentiation is quite impossible.

Clinically, we note three distinct types:—

1. The moderate or mild.
2. The severe.
3. The malignant or cerebral.

I prefer the classification given by Corlett[1]:—

(a) Simple.
(b) Septic.
(c) Toxic.

Etiology.—*Scarlet Fever and Milk:* Hall[2] in a very interesting article, found, after an extensive review of the literature, that, "while scarlet fever occurs in epidemic form in those countries where cows' milk forms a staple article of food, especially among children, it does not occur in countries where cows' milk is not used as a food, or where children are raised on mother's milk only." This is true of Japan, where cows' milk is not used and domestic animals are scarce, and it is true in India, also, where, though cows' milk is used, the children are nursed by their mothers until they are 3 or 4 or even 6 years of age.

While this immunity from scarlet fever, together with the absence of cows' milk as an article of food, may be simply a coincidence otherwise explainable, does it not suggest the possibility of infection through the gastro-intestinal tract as perhaps the chief source?

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[1] In his excellent treatise on the "Acute Infectious Exanthemata."

[2] H. O. Hall: New York Medical Record, November 11, 1899, p. 698

Climate.—Epidemics are more common in America in the fall and winter than in the summer months, although I have seen malignant cases both in hospital and private practice just as bad in midsummer as in midwinter. We know by clinical experience that the poison of scarlet fever is less volatile than that of measles, and is not transmitted any great distance through the atmosphere (Hall).

TABLE NO. 89.—*Deaths from Scarlet Fever, in Children Under 15 years—Old City of New York.*

		Total.	0 Year.	1 Year.	2 Years.	3 Years.	4 Years.	Under 5 Yrs.	5-10 Years.	10-15 Years.
1890	Males	198	9	35	39	30	30	143	50	5
	Females	201	14	40	42	36	24	156	39	6
1891	Males	600	40	105	133	116	70	464	120	16
	Females	588	26	95	124	106	72	423	155	10
1892	Males	464	39	63	99	90	55	346	101	17
	Females	469	29	74	105	77	53	338	116	15
1893	Males	275	24	40	55	53	34	206	61	8
	Females	258	23	40	54	43	30	190	62	6
1894	Males	252	17	50	50	42	35	194	50	8
	Females	261	14	39	59	43	34	189	67	5
1895	Males	241	16	34	72	50	27	199	36	6
	Females	215	12	41	38	47	20	158	47	10
1896	Males	201	8	34	54	32	20	148	53	
	Females	194	12	25	43	49	13	142	46	6
1897	Males	262	10	56	47	49	31	193	65	4
	Females	231	15	33	46	48	30	172	54	5
1898	Males	241	18	48	49	50	20	185	51	5
	Females	265	18	40	54	57	40	209	52	4
1899	Males	158	10	27	36	28	19	120	35	3
	Females	169	8	32	34	31	16	121	39	9
1900	Males	177	22	40	35	27	15	139	30	8
	Females	122	6	22	26	14	22	90	25	7
1901	Males	309	11	47	45	54	52	209	76	24
	Females	297	18	39	47	43	48	195	88	14

When Contagious.—Eichhorst says it is least contagious *during the period of incubation,* most pronounced at the time of eruption, and with the establishment of convalescence and advancing desquamation the power of contagion steadily diminishes. The average duration of the contagion is six weeks.

Age.—The greater number of cases occur between the ages of 1 and 5; next in frequency, 5 to 15. Then the frequency gradually diminishes.

Stage of Incubation.—Authorities differ as to the length of time that usually elapses between the exposure to the disease and the disappearance of symptoms. The usual rule is from a few days to a week, although exceptions will extend the time to several days longer.

Eichhorst and Von Leube give it from four to seven days. Individual susceptibility plays an important part in scarlet fever as well as we have seen in other diseases.

Henoch maintains that we cannot form an idea of the severity or mildness of an attack by the early symptoms.

TABLE NO. 90.—*Statistics of Cases of Scarlet Fever Treated in the Riverside Hospital, New York City.*

Year.	Number of Cases.	Deaths.	Mortality Per cent.
1903	835	76	9.1
1904, Jan. to Oct.	718	46	6.4

Bacteriology.—The distinct specific cause of scarlet fever is unknown, in spite of immense scientific work. A specific micro-organism first described by Class[1] is a non-capsulated diplococcus, appearing occasionally in *streptococcic form,* polymorphous in character. It is constantly found in the pharynx in scarlatinal angina.

Baginsky and Sommerfeld[2] found a *streptodiplococcus* in the pharynx and blood in scarlet fever, which they believe to be the etiological factor in that disease. As yet scarlet fever cannot be reproduced in animals, and hence this microbe must be looked upon as the *probable causative factor.* Owing to the immense amount of research work being done, the day is not far distant when the specific factor of all infectious diseases will be discovered.

Antitoxic Substances from the Blood of Convalescing Cases of Scarlet Fever, Measles, Pneumonia, and Diphtheria.—O. Huber and F. Blumenthal[3] succeeded in deriving from the blood of convalescent cases in above diseases *specific antitoxic substances* in solution. Used in treatment of scarlet fever they found that the disease was shortened, the severity lessened; although they state they have not discovered a healing serum, they believe that they will be able to isolate therapeutic antitoxic substances possessing curative properties.

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[1] New York Medical Record, September, 1899, p. 330.

[2] Berlin Klin. Woch., No. 22, 1900, p. 588.

[3] Paper read before Charité Aerzte, of Berlin, July, 1897.

Leucocytosis in Scarlet Fever.—Dr. J. M. Bowie[1] gives a comprehensive review of the subject, and cites the results of the examination of 167 cases with a total number of 714 counts. Of these 77 were differential to determine the relative percentage of the three main varieties of leucocytes. The following is the summary of his conclusions:—

1. Practically all cases of scarlet fever show leucocytosis.

2. The leucocytosis begins in the incubation period, very shortly after infection; reaches its maximum at or shortly after the height or severity of the disease, and then gradually sinks to normal.

3. In simple, uncomplicated cases the maximum is reached during the first week, and the normal generally some time during the first three weeks.

4. The more severe the case the higher is the leucocytosis, and the longer it lasts; the slighter the case the slighter the leucocytosis, and the shorter time it lasts.

5. A favorable case of any variety of the disease has always a higher leucocytosis than an unfavorable one of the same variety.

6. The temperature has no effect on the leucocytosis.

7. The polymorphonuclear leucocytes are increased relatively and absolutely at first, and then fall to the normal, the lymphatics acting inversely to this. This cycle of events occurs in simple cases within three weeks.

8. Eosinophiles are diminished at the onset of the fever. They increase rapidly in simple favorable cases till the height of the disease is past, then diminish, and finally reach the normal some time after the sum total leucocytosis has disappeared—in short, when the poison has all been eliminated.

9. The more severe the case the longer are the eosinophiles subnormal before they rise again. In fatal cases they never rise, but sink rapidly toward zero.

10. The leucocytes, in complications, go through a cycle of events similar in all respects to that of the primary fever as regards both sum total and differential leucocytosis, and the same laws govern the behavior of the leucocytes in both cases.

In regard to the diagnosis of scarlet fever, the simple counting of the leucocytes gives little aid. A differential count, however, may be of aid, for scarlet fever is one of the few acute infectious diseases where one finds an increase in the eosinophiles early in the disease and the persistence of that increase for some time.

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[1] *Reported* in Berlin Klin. Wochenschrift. (No. 31, 1897.)

With regard to prognosis, the examination of the leucocytes seems likely to be of some practical value. In scarlatina simplex, if the case be severe, and the leucocytosis be high and rising, one may predict a favorable course; and conversely, if it be low and stationary, one may expect a tedious case. Regarding the differential count, if the eosinophiles show a relative increase, the augury is good; if they are normal or subnormal after the first day or two, then the case will in all probability be a severe one. Furthermore, as long as a relative increase of eosinophiles is present one cannot be sure that some complication will not ensue; whereas, if the eosinophiles have come down to normal in the usual way, one may be free from anxiety in this respect.

Pathology.—The gross and histological lesions found post-mortem in scarlet fever depend essentially upon two processes: first, the action of the scarlatinal toxin, associated with the changes seen in any acute febrile disease; and, secondly, they may occur as a result of a mixed infection due to entrance into the organism of the streptococcus pyogenes, the staphylococcus pyogenes aureus or albus, the pneumococcus, and rarely, other micro-organisms. So long as the specific agent concerned in the scarlatinal infection remains obscure, it must be impossible—in many instances, at least—to determine, in a given case, which of these two elements is the predominant one. In cases succumbing early in their course to the intensity of the poison, before the development of secondary infections, we must assume the changes present to be due to the specific scarlatinal virus, while in those which prove fatal later, associated with grave throat lesions, streptococcic angina, etc., the possibility of an added etiological element in the lesions present after death must be admitted (Corlett).

Symptoms.—The onset is usually very sudden. In young children the attack is preceded by a convulsion. Vomiting is an early symptom.

Tongue.—The tongue has a whitish fur and the papillæ will be found elevated and very red. It has the so-called "strawberry" appearance (see colored plate). The throat, especially the tonsils, will be found intensely congested and dry. Sometimes a severe diarrhœa is the first symptom. The pulse is full and rapid, from 120 to 140 beats per minute. The temperature on the first or second day is about 102° F., rarely higher than 103° F.

The submaxillary lymphatic glands at the angle of the jaw are swollen and tender on palpation. The mucous membrane of the mouth is reddened. The pharynx, tonsils, and the uvula are injected. Monti[1] calls attention to an enanthem in scarlet fever which is seen late on the first day or early on the second. It is a diffused, mottled reddening which begins upon the uvula, spreads quickly over the hard and soft palate, covering the pillars of the fauces, and finally the mucous membrane of the cheeks. It does not as a rule extend to the post-pharyngeal wall.

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[1] Jahrb. f. Kindh., vol. vii, p. 227.

The Urine.—There is febrile albuminuria present, which disappears as the temperature declines. The urine is scanty and high-colored.

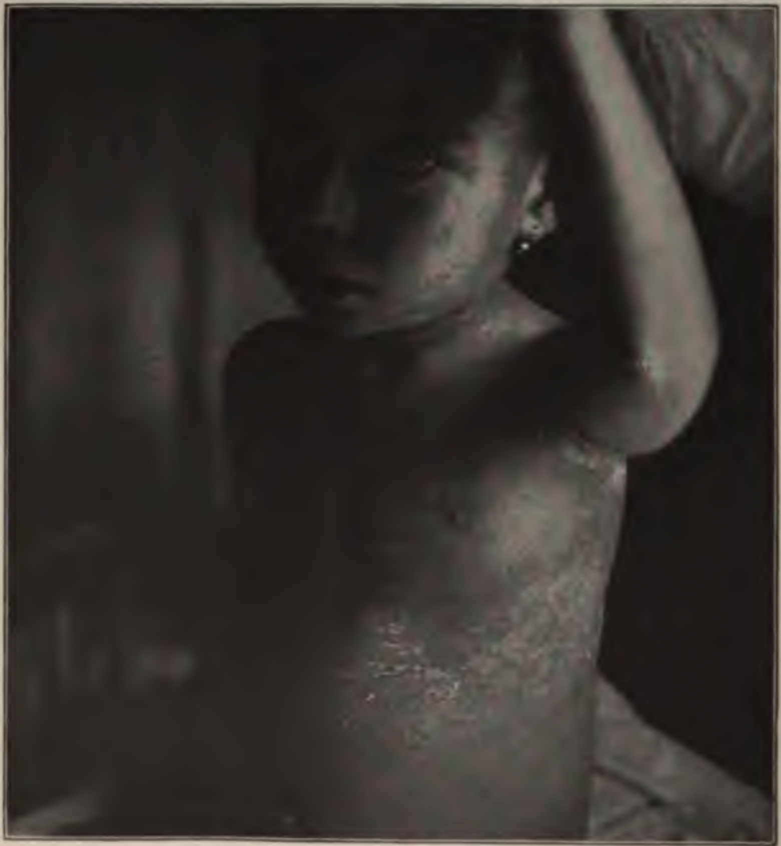
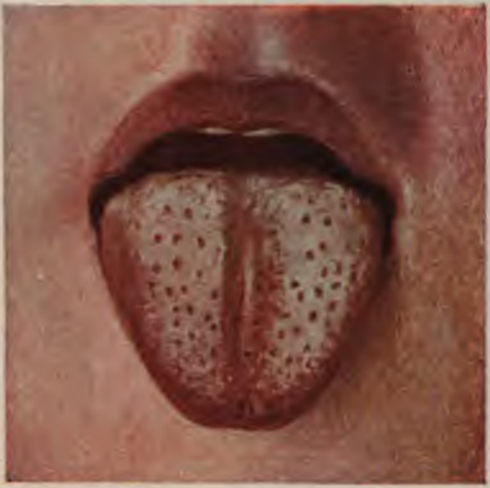


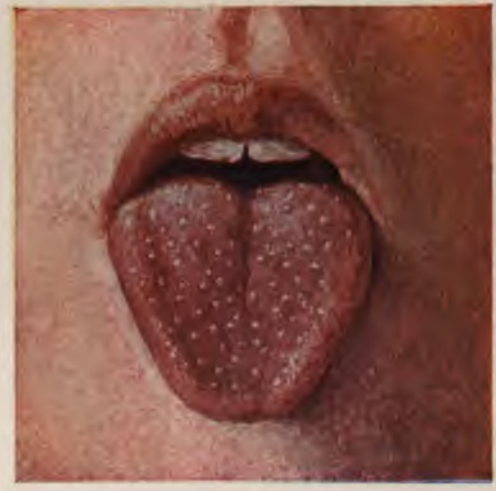
Fig. 201.—Desquamation of the Left Side of the Chest in a case of Scarlet Fever. Photographed from a case in the Riverside Hospital. (Original.)

The Rash.—This appears usually within the first twenty-four hours. It is first seen upon the neck and chest—less often upon the small of the back. It is a bright scarlet pin-point flush, and occupies the sites of the hair follicles. The rash extends from above downward, spreading in a few hours to the arms; usually in twenty-four hours it reaches the trunk, legs, and abdomen. (Study frontispiece.) A point to note is that in contrast

PLATE XVII



Strawberry Tongue in Scarlet Fever. Painted from a case in the Riverside Hospital. The body rash is shown in the Frontispiece. (Original.)



Beefy Tongue in Scarlet Fever. The tongue has a glazed appearance. The papillæ are enlarged. This type is usually seen when desquamation begins, after the rash has faded. Painted at the bedside from a case in the Riverside Hospital. (Original.)

to measles and smallpox it is much less marked upon the face and cheeks. The immediate neighborhood of the nose and mouth remain free from the eruption and have a peculiar pallor, a marked contrast to the parts affected by the eruption. The dorsal surfaces of the hands and feet show the eruption. The palmar and plantar surfaces, though frequently injected, do not usually show the true punctate scarlatina rash.

The rash shows great variations. While it may show large or small faintly scarlet colored patches lasting but a short time, the opposite more frequently occurs. When it is diffuse it may be of an intense scarlet or almost purple color. (See frontispiece.) It frequently shows a tendency to stain the tissues and minute hæmorrhages may occur with the formation of petechiæ. The symptoms above described increase in severity so that the clinical picture of a grave septicæmia is apparent. An improvement in cases which recover should not be expected in the evening. The pharyngeal symptoms of ulceration show improvement and the lymphatic glands are less swollen. The urine, which has heretofore been diminished in quantity, becomes more abundant.

Desquamation.—The desquamation of the skin in scarlatina begins over those areas on which the rash was first seen, namely, the thorax and neck. Thus we will frequently find evidences of desquamation on one part while another part of the body has distinct traces of the rash.

Character of the Desquamation.—On the neck, face, and trunk the epidermis peels off in fine, flaky scales. This is known as *desquamatio furfuracea.* This is similar to the desquamation found in measles. The extremities, about the hands and feet, show the characteristic desquamation. The epidermis peels off or can be stripped off in shreds of varying lengths. This is known as *desquamatio membranacea or lamellosa.* Corlett mentions an instance of a cast of a finger and of a hand being peeled off during desquamation.

Duration of Desquamation.—This varies greatly and is influenced by the severity of the infection and the intensity of the eruption. It persists longest where the epidermis is thick, namely, about the hands and feet. *As long as a single flake of necrotic skin remains, the patient may be a source of contagion.*

The length of time for complete desquamation may be from six to eight weeks. It may be of a shorter or longer duration. Repeated desquamation is not uncommon, so that we can say there is secondary and, less frequently, tertiary desquamation.

VARIETIES.

Toxic Scarlet Fever.—This is the most malignant form and is very rare. The disease is very abrupt in its onset. The temperature reaches 105° to 107° F., and sometimes higher, within the first few hours.

The pulse is greatly accelerated and is weak and intermittent. The cheeks and lips are blanched and may show cyanosis very early. The urine is scanty, high-colored, and albuminous, or may be completely suppressed. There are marked cerebral disturbances, such as convulsions and active delirium. Frequently we have marked dyspnœa, the respiratory rhythm being short and quick, due usually not to any change in the lungs at this time, but probably to irritation of the respiratory centers, according to Ausset. Ataxic and adynamic forms are characterized by early and profound constitutional depression, due to the effect of the toxin on the nerve centers, the symptoms rapidly assuming a typhoidal type.

In the hæmorrhagic forms the exanthem acquires a dark purplish hue. Small petechiæ, varying in size from a pin-head to a lentil, appear scattered irregularly over the body. The blood oozes from the gums, the sputum even being tinged with it, while epistaxis may be severe. Blood may be discharged from the bowels or the stools may be tarry in color.

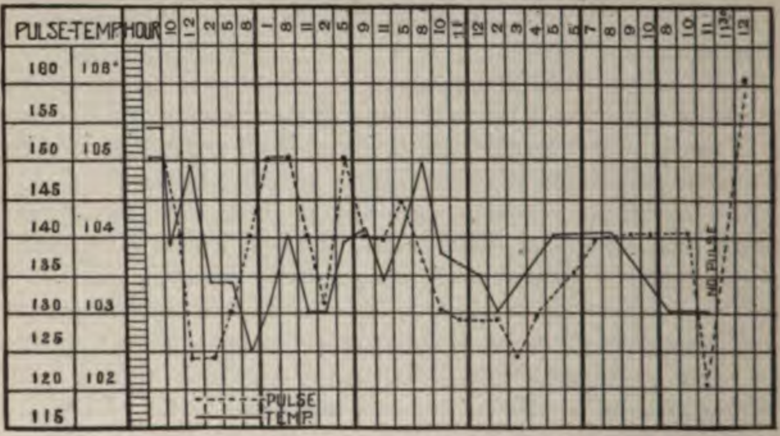


Fig. 202.—Septic Scarlet Fever with Myocarditis, Suppurative Arthritis, Double Purulent Otitis, General Pyæmia. Case seen in consultation in private practice. Child 4 years old. (Original.)

Bleeding is frequently seen from the genito-urinary tract or the urine shows the presence of blood. This form of disease is usually encountered in very feeble infants under 2 years of age and is invariably fatal.

Septic Scarlet Fever.—This type is most commonly met with in children. The symptoms are of a more severe type. There is high and continued fever, with involvement of the pharynx and tonsils. Prostration is *the* vital symptom showing the evidence of severer infection. There are *marked* cerebral symptoms, such as extreme restlessness, convulsions, or mild delirium. In this type we usually have persistent vomiting associated with general apathy. The fever rises suddenly to 105° F. or 40.5° C., or higher. The pulse becomes very small and rapid, from 140 to 160 per minute, although at times 200 per minute. The thirst is extreme; the mouth being dry and gums parched. The throat, especially the tonsil, is deeply injected and frequently has scattered foci of exudate on the surfaces. The urine is concentrated, and invariably contains albumin.

Scarlatina Sine Exanthemata.—Cases frequently occur in which every evidence of scarlet fever exists, but there is no eruption. Henoch states that he believes the eruption is always present and thinks that it is occasionally overlooked. The eruption is frequently of such an evanescent character that it entirely escapes notice, but a subsequent desquamation and nephritis will usually strengthen the diagnosis.

A case of scarlatina sine exanthemata was seen by me in the family of Dr. J. Lurie, of New York City. *A child about 4 years old* had been in apparent health. There was no history of vomiting nor any gastric disturbances. No history of exposure to scarlet fever. When examined by me I found no evidences of scarlet fever. The throat was somewhat congested, but had no patches, nor was there any evidences of necrotic membrane visible in any portion of the throat. The lymphatic glands of the neck were not enlarged. *The urine was very scanty and contained more than 50 per cent. by volume of albumin.* Blood was also present in large quantity. There were also hyaline, epithelial and granular casts present, when a drop was examined under the microscope.

The child's urine was greatly diminished in quantity, hardly a tablespoonful being passed at one sitting. Diuretin and citrate of potash acted very well as diuretics, and later the secretion of urine was normal in both quality and quantity. At times it seemed as though the urine consisted of pure blood. Later the child developed an otitis media—which was preceded by a rise in temperature. The child made a good convalescence and is perfectly *well to-day.*

It may be of interest to note that the child was fed exclusively by the percentage method at the Walker-Gordon Laboratory.

Scarlatina Papulosa.—Small slightly elevated papules of a dark-red color develop at the site of the hair follicles. They are more readily detected by the finger than by the eye, and are observed twelve to eighteen hours before the ordinary scarlatinal rash appears.

Scarlatina Variegata.—This form is marked by an extremely irregular distribution of the eruption, frequently associated with the development of well-defined macular areas of an intense red color, situated at the site of the hair follicles, and in many instances simulating the exanthem of measles.

Scarlatina Sine Febre.—Among extremely mild cases of scarlatina instances are frequently seen in which *after a slight initial rise,* the disease progresses without any subsequent elevation of temperature above 98.5° to 99° F., every other symptom being present, but in a mild degree.

Henoch reports 4 cases out of 175 with irregularities of temperature.

Fever of an inverted type has been reported by Henoch, who noted the temperature curve quite the reverse of normal, in which the temperature was higher in the morning than in the evening.

Scarlatina Sine Angina.—This form of scarlatina has very slight throat symptoms or so insignificant as to appear almost absent. A slight congestion of the throat is visible, and usually a faint enanthem is present early in the disease.

The tonsils are not enlarged, but there is an almost constant *enlargement of the papillæ* at the tip and edges of the tongue—an *important diagnostic aid.*

Complications.[1]—*Scarlatina with Other Exanthemata:* Mixed infections are frequently noted. Measles, chicken-pox, or smallpox are met with. Corlett depicts a case of scarlatina with chicken-pox.

I have seen a case of scarlet fever complicated with measles, in private practice, in consultation with Dr. Harry Weinstein, of New York City. Mixed infections have been seen many times during my service in the scarlet fever wards of the Riverside Hospital—scarlet fever and whooping-cough, scarlet fever and measles very often, scarlet fever and diphtheria as well.

The Throat.—Scarlatina is usually seen very early in the pharynx and fauces. This takes place whether we are dealing with a mild or severe infection. We know that certain pathogenic bacteria, such as streptococci, are invariably found during the course of scarlatina.[2]

Many bacteriologists agree that the Klebs-Loeffler bacillus is usually absent, though there are many cases of true diphtheria complicating scarlet fever. Several cases of diphtheritic angina have been seen by me while on service at the scarlet fever wards of the Riverside Hospital. Lemoine found the streptococcus pyogenes in 93 cases out of 117 studied by him. The Klebs-Loeffler bacillus was found in addition in 5 cases of this series, and the bacillus coli communis in 9 cases.

Angina Pseudomembranosa (of Streptococcic Origin).—False membranes upon the tonsils or pharynx are seen in the severe and septic types of this disease. It is simply a necrotic inflammatory deposit. On the second day the mucous membrane of the pharynx is intensely reddened and congested. The tonsils, which are much inflamed and swollen, show scattered, irregular patches of gray or grayish white exudate, completely occluding the tonsillar crypts over a more or less limited surface. One or both tonsils may be affected. In many instances the pharyngeal inflammation from the beginning shows an extreme grade of intensity. This may spread over the

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[1] "Vulvo-vaginitis Following Scarlet Fever" is described on page 403 (chapter on "Vulvo-vaginitis").

[2] See elaborate clinical and bacteriological studies made by Baginsky and *Sommerfeld*, in Archiv. für Kinderheilkunde, 1900, and Berlin. Klin. Woch., No. 22, *1900, p. 588.*

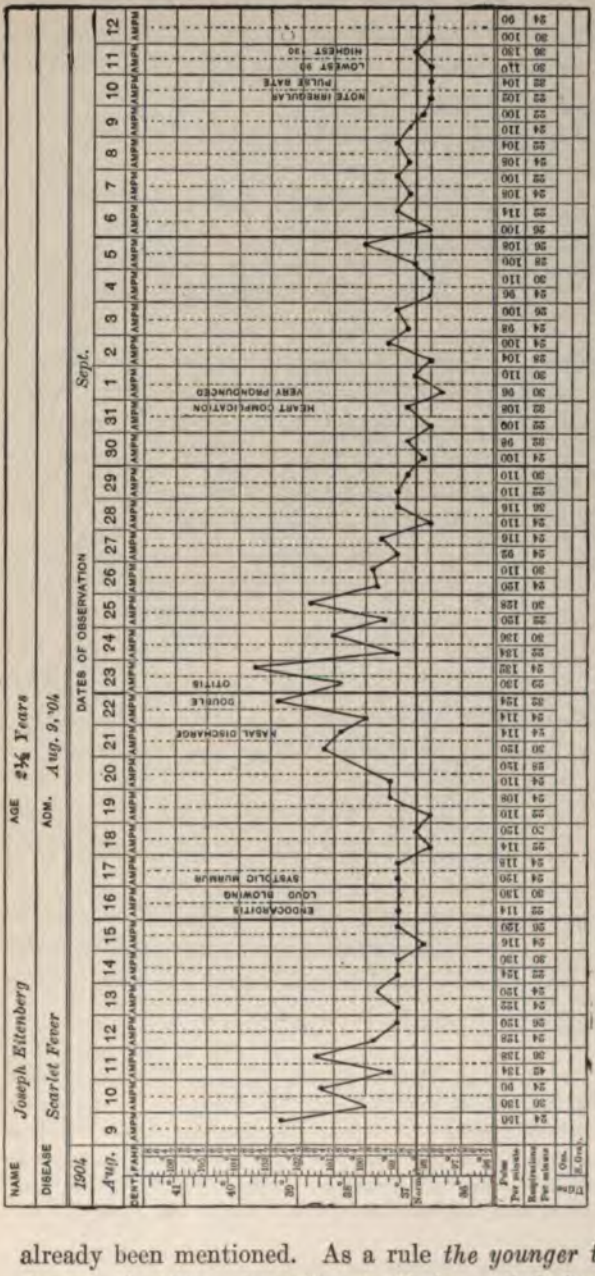

Fig. 203.—Chart Showing Temperature and Complications in a Case of Scarlet Fever. From Author's Service at the Riverside Hospital.

posterior pharyngeal wall, the hard palate, and the mucous membrane of the posterior surface of the cheek; also, to the posterior nares and the Eustachian tube, with resulting extension of the inflammatory process to the middle ear. There is a very foul odor to the breath, and usually a thin acrid secretion from the nostrils, causing excoriation, fissures, and, rarely, rhagades.

The nostrils may be occluded and the mouth held open in an attempt to breathe.

Angina Scarlatina Membranosa (of True Diphtheritic Origin). — This should be regarded as a true diphtheritic complication and treated as diphtheria (see chapter on "Diphtheria").

Otitis. — The extension of the infection from the pharynx through the Eustachian tubes has already been mentioned. As a rule *the younger the child,* the greater the danger of otitis. According to Bader and Guinon, the mild or catarrhal form occurs in 33 per cent. of all cases of scarlet fever, and the purulent form is less common, occurring in 4.5 per cent. of all cases.

Caiger, reporting 4015 cases of scarlet fever, noted ear discharge in 11.05 per cent. In a series of 397 cases observed by me, including severe, malignant, and all complicated varieties, there were 82 middle ear discharges, 68 purulent, and 14 catarrhal.

About 20 per cent. of all cases seen by me had middle ear trouble. It is important to have the *middle ear examined* when *high fever persists* during an attack of scarlet fever. *Persistent high fever in a case of scarlet fever occurred in my private practice. It was also seen by Dr. J. W. Brannan and by Dr. Dench. After an examination of the middle ear, a thorough incision of the drum membrane liberated pus and relieved the temperature for a time.*

The hand will frequently be carried to the head or ear. The neighboring lymphatic glands are enlarged, palpable, and may be tender. After a few days, unless relieved by incision, the tympanic membrane ruptures spontaneously. The symptoms then usually subside. When, however, the inflammation becomes purulent *(otitis media suppurativa)*, then the condition is serious, owing to the possibility of deafness arising.

Empyema of the mastoid antrum,[1] resulting from chronic suppurative otitis media, occurs in a small percentage of cases. With the establishment of a communication between the tympanic cavity and the cells of the mastoid, there is usually a slight decrease in the amount of discharge from the ear. The temperature rises to 104° F., or higher, and shows a marked fluctuation of a remittent character. There may be rigors. If old enough the child will complain of pain in the mastoid region with tenderness on palpation over the mastoid process.

The pulse becomes rapid and irregular. These symptoms continue from day to day, and unless an operation is performed these cases will end fatally, due to the development of meningitis.

More rarely an inflammatory swelling appears behind the external ear—situated *over the mastoid*—associated with a rise of temperature, local tenderness, with more or less forward projection of the ear; and occasionally local suppuration, with abscess formation, takes place.

A case of this kind occurred in the private practice of Dr. R. W. Reid, of New York City, with whom I saw the case in consultation. The child had a very severe attack of scarlet fever. It was of a septic character. Necrotic membranes could be seen over the pharynx and tonsils. There was persistent fever. The child was decidedly rachitic. The case was complicated with an acute nephritis. The urine was very scant and was loaded with albumin and casts. Later the right ear discharged pus very freely.

When I saw the child there was a superficial swelling *over the mastoid* which pushed the ear forward. The inflammatory condition was local and due either to periostitis or to a local adenitis, remotely dependent on the middle ear suppuration. An incision made liberated a large quantity of pus. The child died of general septicæmia following toxic nephritis.

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[1] Read article on mastoid (chapter Otitis) page 857.

Angina Ludovici (Tippet Neck).—This may occur about the fifth day of the disease, though more commonly seen early in the second week of the attack.

The skin is indurated, glossy, and may pit on pressure, though it may give no sense of fluctuation. The process may be limited to the angle of the jaw or involve the entire neck; it may extend downward to the clavicles and upward along the sides of the face and head, rendering the head almost if not wholly rigid. The diffuse cellulitis of the deeper tissues constitutes one of the gravest complications of scarlet fever, proving almost invariably fatal. Death results from a rupture of one of the large vessels, the jugular vein or internal carotid artery, or, as a result of thrombosis or embolism, with fatal meningitis or pyæmia. The greater the toxæmia, the more pronounced the lymphatic enlargement.

The Lymph Glands.—The neighboring glands are enlarged and tender on palpation. The infiltration of the glands may be extreme, and in rare instances an excessive infiltration of the cellular tissue of the neck occurs, which becomes hard and indurated, and occasionally renders the head immovable.

Phlegmonous Inflammation of the Neck—Diffuse Cellulitis.[1]—Schamberg studied the glands in 100 cases of scarlatina. He found the maxillary glands enlarged in 95 per cent. and the submaxillary glands enlarged in 36 per cent. of his cases. The posterior cervical glands were found enlarged in 77 per cent. of the cases. Sometimes the parotid glands are also involved. Frequently the inflammatory condition persists and suppuration occurs, resulting in so-called phlegmonous inflammation. Even when freely incised there is danger of pus burrowing beneath the connective tissue. Sometimes a rapid and diffuse cellulitis with excessive infiltration of the deeper tissues is associated with the suppurative process.

Retropharyngeal abscess occurs occasionally.[2] Bokai found 6 cases out of 664 cases of scarlet fever.

Schamberg, in a study of the lymphatic glands in scarlatina, found the various groups enlarged in the following proportion in 100 cases:—

Inguinal glands	100 per cent.
Axillary	96 per cent.
Maxillary	95 per cent.
Posterior cervical	77 per cent.

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[1] Schamberg: Annals of Gynæcol. and Pediatry, December, 1889, vol. viii, p. 39.

[2] Jahrbuch f. Kinderheilkunde, vol. x, p. 108.

Anterior cervical	44 per cent.
Submaxillary	36 per cent.
Epitrochlear	26 per cent.
Sublingual	25 per cent.

As a result of the analysis of these 100 cases he finds that the maxillary glands commonly attain the largest size, and also most frequently undergo suppuration. In all cases examined on the second and third day of the disease the enlargement of the lymphatic glands was well marked.

Scarlatinal synovitis (so-called scarlatinal rheumatism or pseudorheumatism) is occasionally met with. Ashby[1] met with this condition in 2 per cent. of his cases.

Hodge found synovitis in 117 out of 3000 cases studied, or 3.2 per cent. There are two distinct forms:—

(a) Simple catarrhal or serous synovitis.

(b) Suppurative or purulent arthritis.

The streptococcus pyogenes has been found in both forms in pure culture and combined with other micro-organisms.

This complication occurs more often in children over 5, and is rarely met with in children under 3, according to Holt.

The symptoms met with are: Pains in the affected joints, swelling, which may or may not be marked with slight impairment of motion, some redness, and a slight rise in temperature.

Owing to an effusion of serum, large joints, such as the knee and shoulder, remain swollen many weeks. When suppuration develops in the involved joint, Henoch claims that it is due to emboli, following septicæmia.

The Kidneys.—There are three forms of involvement of the kidneys in scarlatina:—

1. Transient febrile albuminuria and the interstitial catarrhal nephritis.
2. Septic nephritis.
3. Post-scarlatinal nephritis.

Transient albuminuria occurs in three-fourths of all cases of scarlet fever. It does not differ from a "febrile albuminuria" seen in all acute infectious diseases associated with high temperatures. It has no special significance.

Catarrhal nephritis not infrequently occurs in the first week in cases of moderate severity. The urine contains, besides albumin, degenerated epithelial cells, mucous cylindroids, and rarely epithelial or even hyaline casts, occasionally a few red and white corpuscles.

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[1] British Medical Journal, 1883, vol. ii, p. 514.

Clinically, we have slight evidence of œdema. Pathological changes frequently take place without a trace of albumin or without the presence of casts. Such cases have been reported.[1]

Septic Nephritis.—Where the scarlatinal virus causes a general toxæmia, and we have grave throat symptoms accompanied by necrotic deposits on the tonsils and pharynx, there are always swollen glands. Nephritis develops from the intensity of the infection caused mainly by the streptococcus pyogenes. In many instances death occurs before well-defined symptoms of nephritis are made out. In such cases there is no dropsy and uræmic symptoms are absent. In rare instances the urine is normal during the entire attack until a post-mortem shows the existence of nephritis.

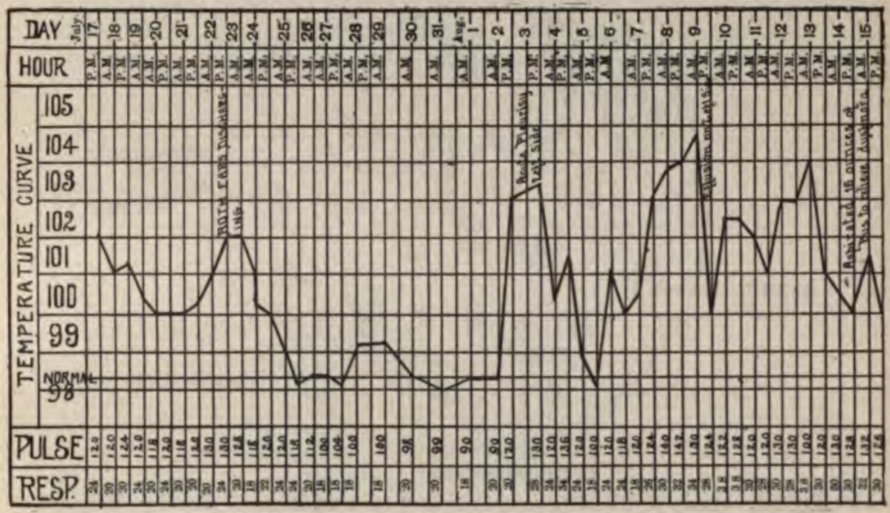

Fig. 204.—Septic Nephritis from Riverside Hospital.

Post-scarlatinal Nephritis.—When the acute symptoms subside and nephritis develops it is called post-scarlatinal nephritis. This nephritis is not always glomerular. Jurgensen's statement that the effect of the inflammatory irritant depends not only upon its virulence (toxicity), but upon the length of time during which it acts upon a given local site, is extremely interesting and important.

Symptoms.—The symptoms may be sudden, although if daily examinations of the urine are made, a gradual diminution in the quantity secreted in twenty-four hours will be noted.

The child who has seemed apparently well and convalescing becomes pale, is restless and irritable, and if old enough, complains of headaches, thirst, and loss of appetite. Constipation may be present. Vomiting is usually an early symptom of nephritis.

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[1] Corlett: "Treatise of Infectious Exanthemata," p. 201.

The earliest symptoms of nephritis are: rise of temperature, occurrence of œdema, however slight, involving particularly the lower eyelids, with distinct puffiness of the eyes. Sometimes the whole face is swollen and bloated. The feet and legs are œdematous, so also the scrotum and penis in the male, and the labia majora in the female. Such œdema may also be seen on the dorsum of the feet and upon the knuckles. There is pitting on pressure.

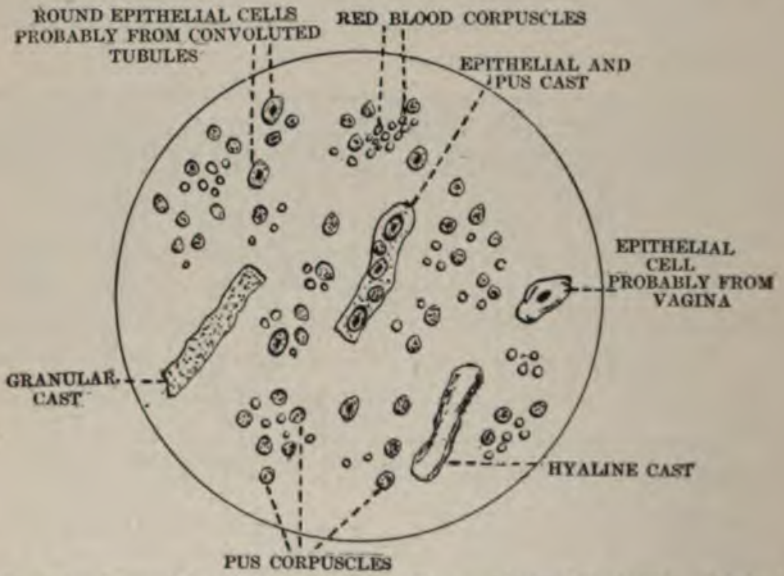
ROUND EPITHELIAL CELLS PROBABLY FROM CONVOLUTED TUBULES
RED BLOOD CORPUSCLES
EPITHELIAL AND PUS CAST
EPITHELIAL CELL PROBABLY FROM VAGINA
GRANULAR CAST
HYALINE CAST
PUS CORPUSCLES

Fig. 205.—Drop of Urine from a Case of Post-scarlatinal Nephritis. Original drawing from a child seen in consultation by the Author.

The urine is greatly diminished in quantity, so that several teaspoonfuls only may be passed in twenty-four hours. The reaction is acid. Specific gravity is from 1.006 to 1.065, the latter being rare. The amount of urea is under 2 per cent. Albumin is present from 0.5 to 1 per cent. and higher. The *diazo reaction* is of no value in scarlet fever.

Microscopically.—There may be present hyaline, epithelial, granular and blood casts, fragmented renal epithelium, white and red blood-corpuscles; the latter in varying numbers; uric acid and oxalic acid in crystalline and amorphous form, and more or less granular *débris*.

Cases are seen now and then in which *almost normal conditions* of the urine prevail and still nephritis exists.

Nephritis usually exists a few weeks, although obstinate cases may continue for months and even years.

Great care should be exercised in giving the prognosis in cases of post-scarlatinal nephritis. Uræmia, when occurring during nephritis, is a grave symptom. It is usually preceded by vomiting, stupor, and peculiar twitchings of the facial muscles.

The pulse is slow; the temperature subnormal; the tongue is dry. Sometimes just the reverse exists and there is high fever, very frequent and small pulse; the respirations are short and hurried, and the skin is dry.

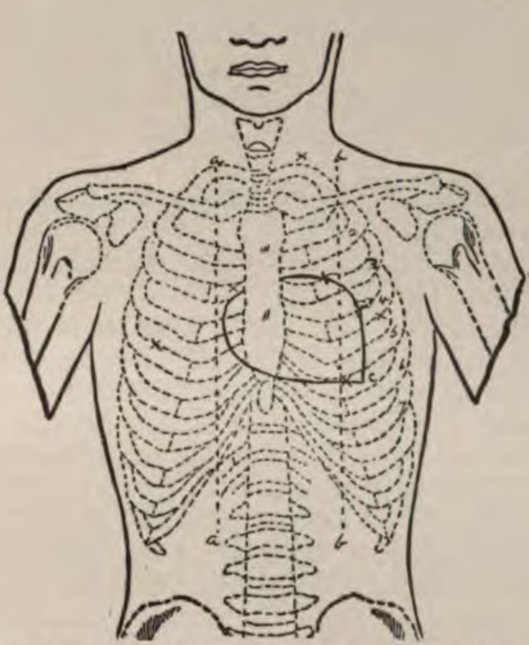

Fig. 206.—The Heart in a Case of Scarlet Fever: *a. a.*, Parasternal line. *b. b.*, Mammary line. *c.*, Apex. *x. x. x. x.*, Location of murmur. From Author's service at the Riverside Hospital.

Convulsions may develop, clonic in character, of varying intensity, involving the face and extremities as a whole. Sometimes only distinct groups of muscles are involved. Cyanosis is marked, complete suppression of urine follows, coma ensues, and usually these cases end fatally.

Anasarca is frequently associated with or subsequent to œdema. We frequently have serous exudations into the serous cavities—pleura, pericardium, or peritoneum. Œdema of the lungs, sometimes œdema of the larynx, results, and is usually fatal. Mayr mentions œdema of the pia mater and ventricles of the brain.

The heart requires careful watching in scarlet fever. Its great susceptibility to the toxin and the danger of paralysis should be remembered.

The heart-sounds may lose their normal tone, the first sound becoming soft and valvular, or they may run together. We have in the beginning tachycardia (increased heart's action), later bradycardia (slowed heart's action). These symptoms point to an existing mild myocarditis, according to Romberg.[1]

In some cases pericarditis or endocarditis may develop. In the majority of cases the *endocardium of the heart wall, rather than the valves,* is involved.

The Lungs.—In addition to the œdema previously mentioned, bronchitis frequently accompanies scarlet fever. Broncho-pneumonia is also frequently noted. Henoch believes bronchial involvement is frequently overlooked. It is no doubt due to accidental transmission of septic material from the throat into the trachea and lungs (so-called Schluck-pneumonie).

It may also be the result of direct infection through the blood-vessels, a part of the general sepsis.

Acute croupous pneumonia occurs more frequently in cases in which scarlatinal nephritis exists.

Pleuræ.—Scarlatinal poison seems to affect the serous membranes of the body, so that inflammation of the pleura is by no means rare. It is usually seen during the second week of scarlet fever and is unilateral. When excessive exudation exists we must watch the case carefully, as a fatal termination is by no means rare. Empyema was seen by me as a complication of scarlatina at the Riverside Hospital.

Gastro-intestinal Tract.—Early in the disease, through infection, very young children have stomatitis—ulceration of the mucous membrane of the mouth and cheeks seriously interfering with nutrition. Actual gangrene can occur. See chapter on "Noma," for the case reported by me.

Diarrhœa and vomiting are frequently noted. Both are early symptoms. Diarrhœa may be:—

(*a*) A simple catarrhal enteritis.

(*b*) Dysentery with bloody, purulent stools.

(*c*) Of a typhoidal character—watery stools with marked tympanites.

Liver.—Enlargement of the liver sometimes occurs. Sometimes atrophy has been noted. Icterus is frequently seen, though it disappears with convalescence. Baginsky maintains that when icterus exists with nephritis, it is to be dreaded particularly as predisposing to the danger of uræmia.

General furunculosis or multiple abscesses are occasionally seen. They are usually met with in children with severe systemic infections, having low vitality.

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[1] Ernst Romberg: "Ueber die Erkrankungen des Herzmuskels bei Typhus Abdominalis, Scharlach, und Diphtherie," Deutsch Archiv. für klin. Med., vol. xlviii, *1891, pp. 369* et seq.

A case of this kind was seen by me in consultation with Dr. Glass of New York City, in which a child, very rachitic, developed multiple abscesses in almost every joint in the body.

Such cases invariably end fatally.

The spleen is frequently enlarged and readily palpable at the margin of the ribs. In some cases it is double its normal size.

Sequelæ.—Tuberculosis rarely follows scarlet fever. Frequently profound anæmia is seen. Occasionally true diphtheria follows, leaving *chronic enlargement of the tonsils* or chronic inflammatory changes in the pharyngeal and nasal mucous membrane.

Forchheimer[1] has reported persistent ozæna as a sequela to scarlet fever. Total deafness or partial loss of hearing is one of the most common sequelæ of this disease.

Chronic nephritis and endocarditis, with resulting permanent lesion of the mitral valves, frequently follow scarlet fever.

Gangrene of Arms and Legs After Scarlet Fever and Other Infectious Diseases.—Eichhorst[2] reports the case of a 4-year-old girl who had an unusually severe attack of scarlet fever. At the end of the third week signs of embolism of the popliteal artery suddenly appeared in the left foot and leg. Gangrene progressed until the line of demarcation was sharply exhibited above the lower half of the leg. Amputation was performed and the child made a good recovery. A thrombus was found in the left popliteal artery 1 centimeter above its bifurcation, extending into both the anterior and posterior tibial arteries for the same distance. The popliteal artery showed signs of endarteritis. Pure cultures of the streptococcus pyogenes were found in the pus from a left-sided otitis media and from an abscess on the forehead.

Only two other cases of gangrene following scarlet fever are reported in medical literature. Both lower extremities were involved in these cases, which occurred in boys aged 4 and 9 years respectively. In all, 166 cases of gangrene occurring in infectious diseases were collected, and of these typhus (42), typhoid (40), and influenza (19) furnish the largest number. Five followed measles, 1 diphtheria, and 1 varicella.

Post-operative scarlatina is met with occasionally. Sir James Paget believes the patients were infected before the operation. Hoffa[3] says that these should be termed *post-operative scarlatinoid erythemas.* A case of this kind was seen by me during the winter of 1902.

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[1] Article on "Scarlet Fever" in "Twentieth Century Practice of Medicine," 1898, vol. xiv, p. 80.

[2] Deut. Archiv. f. klin. Med., vol. lxx, Nos. 5 and 6.

[3] In Von. Volkmann's Sammlung Klin. Vortrage, No. 292; Chirurgie, No. 90, 1886-1887, p. 2679.

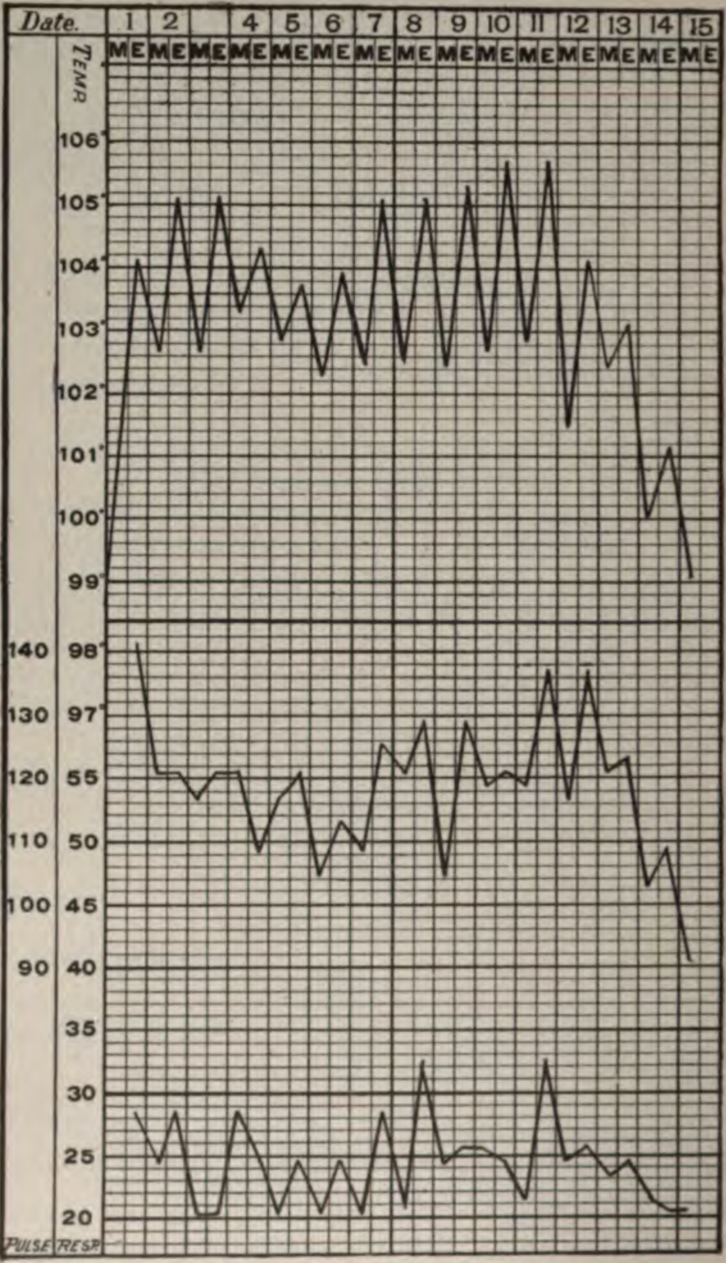

Fig. 207.—Post-operative Scarlatinoid Erythema. (Original.)

A child, 7 years old, was taken to the Manhattan Ear and Eye Hospital and operated for hypertrophied tonsils, by Dr. N. F. Chappell. The case was given the *usual aseptic* care. Two days later I saw the boy with a well-defined scarlatina covering his whole body. The mother assured me that the boy was not exposed to any infection, excepting while waiting in the dispensary with other patients. The otitis media and necrotic pseudo-membranes on the tonsils, also desquamation, certainly completed the clinical picture and strengthened the diagnosis.

The Diagnosis.—When fever exists accompanied by an inflamed throat and an eruption over the body, then the diagnosis of scarlet fever can be made. Later on we have desquamation. The most characteristic early symptoms of a typical scarlet fever are: Intense redness of the faucial mucous membrane, sore throat, early and persistent vomiting, fever, thirst, and increased pulse rate. The tongue is very characteristic—strawberry appearance. (See Plate XVII.) Sometimes an attack of scarlatina is ushered in by convulsions. Older children complain of an intense headache. There is marked constitutional depression and aching of bones. Von Leube maintains that vomiting occurs more often as an initial symptom in this than in any other disease, excepting pneumonia. There is nothing peculiarly characteristic in the early temperature of scarlet fever. It remains elevated after a sudden rise, and subsides gradually by lysis, toward the end of the first week.

Drug Eruptions.—Great care must be taken to learn if a child has received *belladonna, opium, quinine, or antipyrin.* These drugs give an eruption similar to scarlet fever. We should always learn if such drugs have been given before making a positive diagnosis.

Course.—Scarlet fever usually runs its course in about six weeks from the beginning of illness. The disease is spread by the walking cases who have not completely desquamated. It is also spread by cases in the early stages of the disease. Such children usually complain of headache, nausea, and vomiting. A superficial examination or a careless examination of these "spoiled stomachs" has frequently been the cause of the spread of scarlet fever, children being permitted to go to school. In the pre-exanthematous type the diagnosis is difficult unless the throat is carefully inspected. No child should be permitted to attend school until the last evidence of desquamation has disappeared.

Prognosis.—It is very difficult to determine the outcome of a case, especially at the beginning of scarlet fever. A mild rash may have serious complications and a severe rash may run a very mild course without complications. Individual susceptibility plays an important part in forming an opinion as to the outcome of any case of scarlet fever. The following symptoms should influence an unfavorable prognosis: continued hyperpyrexia; continued vomiting; delirium or other cerebral symptoms, such as convulsions or stupor; an irregular anomalous or poorly developed rash, if intense, suggests *extreme virulence; an extremely rapid and feeble or irregular pulse.* Great stress should always be laid on the *condition of the* *heart.* Other complications, such as broncho-pneumonia, or diphtheria, or kidney disease, should be noted as very serious complications.

Treatment.—*Isolation and Care:* The first thing to do in a case of scarlet fever is to isolate and remove all healthy children and adults. The patient should be given in charge of a competent nurse. The best method of isolation is to have one or two rooms on the top floor, with a southern exposure. The nurse should have a cap completely covering her hair. Her uniform should be thoroughly boiled after using. All linen, such as handkerchiefs, bed linen, etc., should be disinfected by soaking in 1 to 2000 bichloride solution before being washed. I have always used the Japanese paper handkerchiefs; they are convenient to wipe the secretions and discharges from nose and mouth, and can be burnt when soiled.

A sputum cup or cuspidor, containing a 5-per-cent. solution of carbolic acid, is very useful. The urine and fæces can be disinfected by adding either a saturated solution of copperas to it or by mixing Javelle water, the ordinary Labarraque's solution of chlorinated lime.

The physician in attendance should protect his clothes by wearing a gown which he removes on leaving the patient's room. He should walk in the open air at least an hour before calling elsewhere.

Hygienic Treatment.—The temperature of the room should be from 68° to 72° F. Fresh air must be admitted; hence proper ventilation is imperative. In winter the patient should be well protected from draughts. Sunshine is imperative, although the eyes should be shielded from direct sunlight. A tepid sponge-bath can be given every morning, and also in the evening, especially if there is profuse perspiration. The child's linen should be changed once a day. When the eruption causes itching, the body should be rubbed with cold cream, carbolated vaseline, or the following recipe is very useful:—

℞ Calamine	1 drachm
Ung. aq. rosar.	1 ounce

M. ft. ungt.
Sig.: Apply over the body once or twice a day.

Forchheimer advises the addition of menthol, 1 per cent., to relieve itching. This can be added to the above.

General Treatment.—Stimulate the Emunctories: The bowels should always receive attention, whether constipated or not; a dose of calomel or several wineglassfuls of citrate of magnesia or villacabras, in wineglassful doses, three times a day, will be found very serviceable.

Lemon juice in the form of lemonade is very serviceable in stimulating the secretion of urine, and also for quenching thirst. The citric acid certainly has a beneficial effect on the throat.

*I have always seen the best results from **keeping the bowels loose and*** *the kidneys active.* That we eliminate toxic products in this manner no one can deny, and we certainly can do no harm by this preliminary treatment.

Fever can also be reduced by the use of the following mixture:—

℞ Tinct. aconite	20 drops
Spir. mindereri	2 ounces
Syr. limonis	1 ounce

M. Sig.: Teaspoonful every hour until sweating is produced, for a child 5 to 12 years old. Younger children one half the dose.

Weak Pulse.—When the first sound of the heart becomes weak, or the two sounds lose their normal tone, stimulation must be commenced. The same is true if the pulse is weak; $^1/_{100}$ grain of strychnine can be given every three hours, or oftener, if necessary. It must be borne in mind that children tolerate strychnine in toxæmic conditions in very large doses. It is a good plan to give coffee with the strychnine or to combine it with caffeine or musk. Digitalis is indicated if the pulse is weak and of low tension. Champagne or whisky is tolerated in extremely large doses. Henoch considers camphor one of the best stimulants when given hypodermically every two or three hours:—

℞ Camphor	1 gram
Ether	10 grams

Sig.: Use hypodermically.

Coma.—In coma the subcutaneous use of sodium-caffeine-benzoate stimulates the heart and arouses the child from stupor. It also stimulates diuresis. When bloody urine exists in addition to gallic acid, suprarenal extract or its alkaloid, adrenaline, can be used in very small doses.

Digitalis should not be used continuously, as it irritates the stomach, and in its stead tincture of strophanthus should be used.

Spartein sulphate, $^1/_4$ to $^1/_2$ grain, injected hypodermically, with distilled water, is useful in cardiac weakness. When meningeal symptoms, such as delirium, cannot be relieved by hot baths, and bromides internally; then the application of several leeches behind the ears, over the mastoid, will be very useful.

Nephritis.—When the first symptom of nephritis appears we must aid the kidneys, skin, and bowels by eliminative treatment. In this manner only can the blood pressure be reduced. The child must be kept in bed, well blanketed. The diet should consist of milk, milk and seltzer, milk and cereals, and buttermilk. If the stomach is irritable then the milk should be peptonized. When extreme repugnance to milk exists, then chocolate may be substituted or some vanilla flavor added to the milk. For thirst give whey, lemonade, or orangeade. To stimulate diaphoresis, hot baths aided by hot packs will be serviceable. The temperature of the bath should be 100° to 110° F. The child is immersed from five to ten minutes. The surface of the body must be continually rubbed during the bath. The patient when taken out of the bath is placed between hot blankets for one hour, so as to aid diaphoresis. To give the *hot pack* the child should be wrapped in a blanket wrung out of hot water, temperature 100° F., and then covered with a dry blanket, over which is placed a rubber cloth. The blanket can also be covered with oil silk.

The pulse should be watched during the bath, and the child should at once be removed if signs of weakness appear.

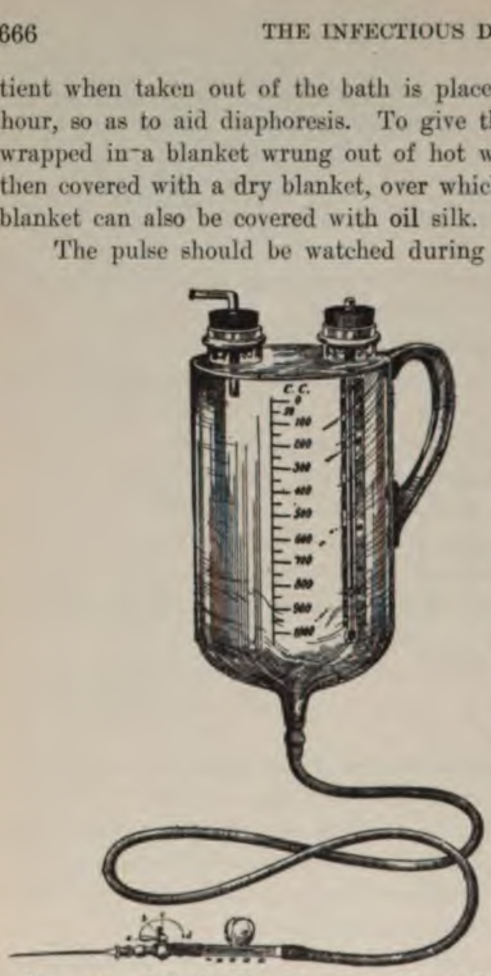

Fig. 208.—Coffey's Glass Apparatus Devised for Hypodermic Saline Injections. The temperature of solutions can be seen and regulated by the thermometer. A second thermometer shows the temperature of the solution as it enters the body. This apparatus can also be used for colonic flushings by removing the needle and attaching a rectal tube.

The Hot-air Bath.—Place the child in bed and cover with two blankets. On either side place hot-water bottles or hot bags of sand so protected that the child cannot be burned. Over these place a rubber cloth or a rain coat. Over the rubber place another blanket. Sweating occurs very easily and very quickly in this manner. In an emergency the ordinary flat-iron can be used instead of the hot-water bottles, for a hot-air bath.

Pilocarpin and jaborandi are such cardiac depressants that they are merely mentioned to be condemned. Nitroglycerine is very valuable. When a general dropsy appears, the danger of effusion into the serous cavities must be borne in mind. When necessary the effusion should be relieved by aspiration. The quantity of urine passed is the most important point which should guide us in determining the result of the treatment. Liquids should be given to stimulate diuresis. The microscopical examination of the urine will also show improvement as it progresses.

If the quantity of urine increases and the percentage of albumin decreases, then our patient is improving. The disappearance of blood corpuscles and casts denotes improvement. One of the best drugs to aid diuresis is diuretine, to be given in doses of 3 grains for a child two years old, and gradually increased until 5 grains per dose is administered. This drug should be given at least three times a day to stimulate the kidneys. Another drug highly recommended by Prof. Baginsky is theocine. It can be given in the same dosage as diuretine and the dose repeated several times a day. This drug will produce a copious flow of urine, and can be recommended because it does not disturb the stomach. Now and then I have noticed that marked vomiting followed the administration of almost any drug during the course of nephritis; hence great care should be taken not to be prejudiced and condemn a drug during the course of nephritis with toxic or uræmic symptoms, if the patient vomits.

Salt-free Diet.[1]—When the kidneys are affected, their activity is diminished, and an excess of salt is stored in the tissues. As each molecule of salt requires a certain quantity of water to hold it in solution, such water will be abstracted from the tissues, giving rise to the dropsical condition. By giving a diet, which is free from salt, we can decrease the edema.

Restorative treatment, such as iron, strychnine, malt extract, and cod-liver-oil should be given after the symptoms of nephritis subside. The child should be kept well protected for at least two months after the first symptoms appear.

As soon as the temperature falls to the normal point we can give:—

℞	Mist. ferri et ammonii acetatis	1 fluid ounce
	Glycerini	1 fluid ounce
	Aquæ	q. s. ad 4 fluid ounces

M. Sig.: A teaspoonful or more every three hours, in water.

Or Basham's mixture may be given:—

℞	Tinct. ferri chlorid,	
	Acid. acetic dil., of each	1 fluid drachm
	Liq. ammonii acetat	6 fluid drachms
	Aquæ	q. s. ad 6 fluid ounces

M. Sig.: Tablespoonful three times daily for a child six years old.

Endocarditis or Pericarditis.—The heart requires careful watching, especially if symptoms of rheumatism appear. Sudden death will frequently occur from heart failure.

A case of this kind was seen by me in consultation with Dr. S. Straus, of New York City, in which a child desquamating with scarlet fever, had myo- and endocarditis. There was a general anasarca. The pulse became very weak during the hot-air bath. The child died suddenly. It is very apparent, therefore, that the hot-air bath is not without its dangers.

Otitis.[2]—The escape of pus from the external auditory canal is by no means rare. The extension of a streptococcus inflammation from the pharynx through the Eustachian tubes can sometimes be aborted by local treatment. Too great stress cannot be laid on the active antiseptic treatment of the nasopharynx as a means of prophylaxis. When earache occurs, no matter how slight, then the ears should be examined. It is better to call an aurist to make sure of the diagnosis and treatment, rather than risk the dangers of mastoid inflammation, with the possible extension of a meningitis and a fatal outcome. Until then, local treatment such as the application of a hot-water bag to the ear, or cotton, inserted into the ear, will afford temporary relief. The danger of using cocaine should not be forgotten, although it is a valuable remedy. When pus is evident, as shown by the bulging of the membrane, then a paracentesis should be performed, and the cavity irrigated with boric acid solution, or equal parts of hydrogen peroxide and sterile water. The ear should not be packed with gauze, but should be permitted to discharge and drain freely. Restorative treatment, such as has been previously mentioned in conjunction with nephritis in this chapter, is indicated.

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[1] L'Echo Medical du Nord, January 20, 1907, p. 25.)

[2] Read also chapter on "Acute Otitis Media."

Diet.—Generally speaking, during the febrile stage and until the end of the second week, an exclusive liquid diet of milk or milk and barley water should be given. If milk is not well digested then whey should be tried (see "Dietary"). Later, beef soup, mutton or chicken broth, buttermilk, all gruels, fruits, fruit jellies, toast, weak tea, weak coffee, cocoa, and chocolate. For thirst—Appollinaris, Vichy, and lemonade. The tendency to nephritis seems to be lessened by giving our patients a milk diet, hence this fact must be borne in mind. Steak juice and egg albumin, diluted with water, can be given later on.

Serum Treatment.—Antistreptococcus serum has been extensively used. It has its opponents and some who extol its virtues. Baginsky[1] reports a series of 48 cases treated with serum, of which 7 were fatal, a mortality of 14.6 per cent.

A clinical study of the value of antistreptococcus serum was reported by me[2] in a paper read before the Section on Pediatrics of the New York Academy of Medicine.

Antistreptococcus serum (Aronson's[3]) was sent to me in the winter of 1902-1903. The serum proved very successful in a series of cases in my private practice.[4]

Through the courtesy of Professor Escherich I saw a number of cases that were treated by Moser's antistreptococcus serum at the Children's Hospital in Vienna while in Europe in May, 1903.

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[1] Berlin Klin. Woch., 1896, No. 33, p. 340.

[2] See "Value of Antistreptococcus Serum," May 12, 1898. Published in Archives of Pediatrics (Louis Fischer).

[3] I am indebted to Messrs. Schering & Glatz for sending me sufficient serum for clinical trial.

[4] *See my* article in the New York Medical Record, March 7, 1903.

All of these serum cases did remarkably well. I was impressed by the excellent results, especially by the *distinct fever crisis,* after the necessary dose of serum was injected. The streptolytic serum made by Stearn is well worth trying in severe scarlet fever.

The following case occurred in my private practice:—

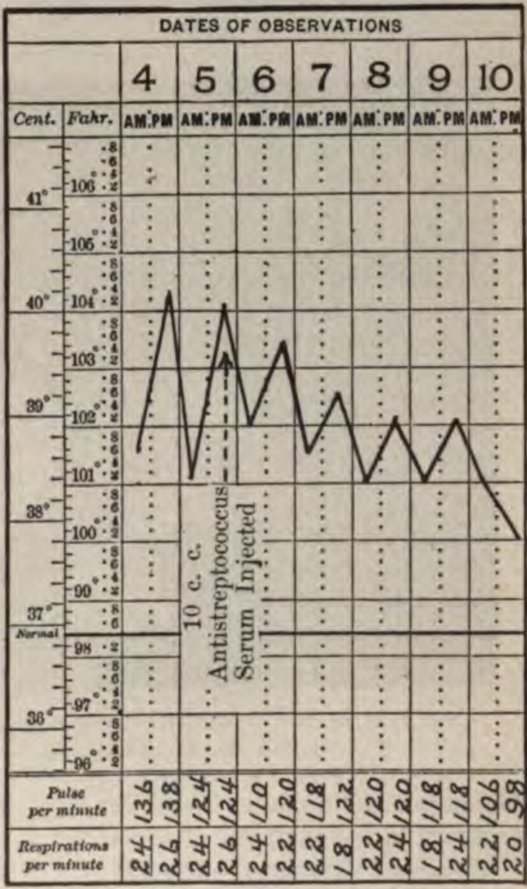

Fig. 209.—Temperature Chart from a Case of Scarlet Fever Treated with Antistreptococcus Serum. (Original.)

Hannah S., 8 years old, was first seen by me February 20th, in consultation with Dr. L. Kohn. The history given me was that the child had been sick three days, with a temperature of 104° F. the day previous and 104 $^1/_5$° F. to-day. The pulse was weak and rapid. Large necrotic patches covered the entire surface of the pharynx, tonsils and uvula. There was a marked fœtor of the breath. A very intense eruption covered the entire body. Diagnosis: *Scarlatina.* There was a loss of appetite and a general apathetic condition. At the time of the injection of the serum, the following condition was noted: Temperature 104 $^1/_5$° F., pulse 138, respiration 26. Owing to the severe general infection, I decided to give an injection of 20 cubic centimeters of antistreptococcus serum. On February 23d, I saw the case a second time with Dr. Kohn and noted the entire disappearance of the necrotic patches in the throat. The attending physician told me that this condition was already apparent on the third day after the serum injection.

The specific action of antitoxin in diphtheria is far greater comparatively than the action attained from the use of this antistreptococcus serum. The clinical results were certainly striking.

The Temperature.—The effect of the serum on the temperature shows that it did inhibit bacterial products. Within twelve to twenty-four hours after the serum injection I have seen a distinct crisis in the temperature. In other cases the temperature was gradually reduced by lysis. (Fig. 209.)

Another interesting observation in most cases is the disappearance, *almost melting away,* of the necrotic membranes after the fourth day. The glands of the neck were swollen and subsided with the disappearance of the throat manifestations. The vital point consisted in a strengthening diet in addition to strict hygiene. I feel warranted in advocating the use of this new serum in the treatment of scarlet fever.

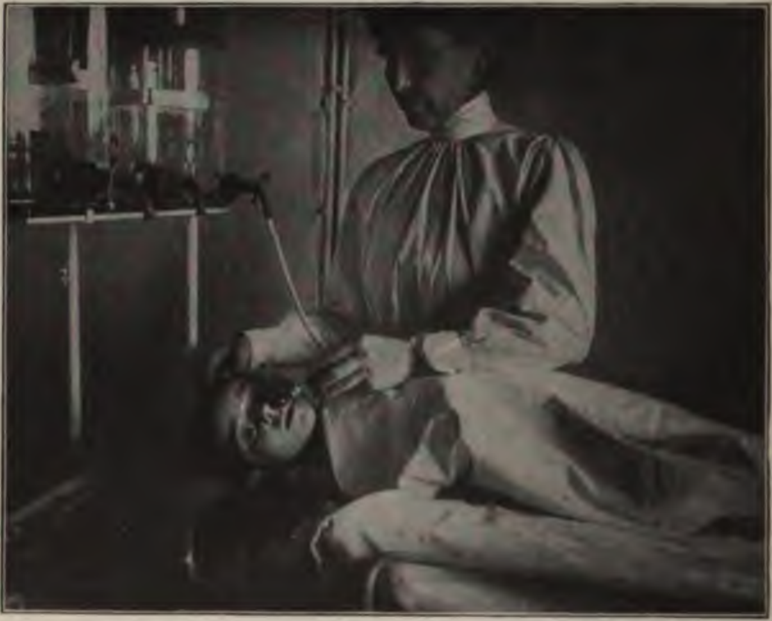

Fig. 210.—Method of Nasal Syringing employed in the Scarlet Fever Ward of the Riverside Hospital. (Original.)

Medicinal Treatment.—*The Throat:* When children are old enough to use a gargle they should be given a mild antiseptic solution such as table-salt solution, using a pinch of salt to a wineglassful of lukewarm water. Gargle every hour.

A spray consisting of 1 to 2000 bichloride directed against the pharynx and tonsils every hour is useful. If spraying is difficult, then swabbing the throat with cotton dipped in bichloride is equally good. High temperature will frequently subside if the nasopharynx is properly irrigated.

The septic accumulations are very serious and cause profound toxæmia unless cleansed thoroughly.

Warm solutions of 1 per cent. ichthyol repeated every six hours are recommended by Seibert. Local applications of 50 per cent. resorcin solution in alcohol, applied on cotton several times a day, are also advised.

Nasal Douching.—My preference has always been for mild saline douches. Hold the child firmly and cleanse the nares with a nasal tip attached to a fountain syringe, at a height of no more than two feet. Permanganate of potash, several crystals to a pint of water, is very good when there is fœtor.

Sulphurous acid has been strongly advocated by some. I saw some excellent results from its use while on duty at the hospital during the summer of 1902 in necrotic scarlatinal angina.

Sulphurous acid has been used by me and certainly can be recommended when extensive necrotic patches exist:—

℞ Acid sulphurous (U. S. P.)	1 drachm
Aquæ	8 ounces

M. Sig.: One teaspoonful every two or three hours.

When the acid used is of full strength, allow it to stand a few minutes before giving it to the patient, so as to permit the gas to escape; otherwise it will be too irritant.

If it is refused an injection can be made with a small glass syringe, throwing the medication as far back as possible.

℞ Natrium sozoiodol,
Flor. sulphur.................................of each equal parts
M. For insufflation into the nostril three or four times a day.

This seemed to exert a very beneficial effect on the necrotic tissue, causing a clearing of the throat.

If the treatment causes nausea or vomiting, then the sozoiodol natrium can be given internally in the following manner:—

℞ Natrium sozoiodol	2.0
Aquæ	100.0

M. D. Sig.: Teaspoonful every hour.

Swollen Lymph Glands.—In septic scarlet fever with necrotic pseudomembranes in the throat, the adjacent lymph glands will be swollen.

At times there is an extensive œdema and infiltration extending into the glottis which can result in asphyxia.

Such cases will be benefited by the use of thorough inunctions of *Credé ointment.*[1] It must be distinctly understood that no result will be noted unless the ointment is rubbed into the swollen glands at the angle of the jaw for at least fifteen minutes. This can be repeated several times a day.

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[1] Schering & Glatz, agents, New York City.

I also have used inunctions along the spine to promote absorption over a greater area. This has proven very efficacious in many cases.

Forchheimer advocates the use of sterile normal salt solution subcutaneously. This is done to stimulate diuresis and also to aid in the elimination of toxins. In my own practice I have found marked benefit from irrigating the colon with a rectal tube introduced about six inches, *using several pints of normal salt solution at a temperature of 110° to 115° F.* This is a very rapid and convenient method in an emergency, especially when one is hampered by necessary irrigators and needles, as we require only an ordinary fountain syringe and the rectal catheter connected with it.

Immunity from Diphtheria.—An injection of 500 to 2000 antitoxin units will confer immunity from diphtheria in a case of scarlet fever.

Diphtheria.—If diphtheria complicates scarlet fever, then the usual treatment of diphtheria should be instituted (see chapter on "Diphtheria").

At the Riverside Hospital every case of scarlet fever is injected with 500 to 1000 diphtheria antitoxin units as a prophylactic measure. By this means Dr. Richardson believes that we have reduced the complication of diphtheria in about 50 to 75 per cent. of all cases.

Fever.—The use of tepid water as an antipyretic measure is the safest means of reducing fever without depressing the heart. Each fever should be studied by noting how much depression is caused by it—how the child stands the temperature. If the child appears bright and cheerful and there is little constitutional disturbance from high fever, then cool sponging or tepid packs may be ample; if, however, there is marked depression, then a warm bath may serve our purpose much better. When a bath is used, the child should be immersed in a tub of water having a *temperature of 90° F.*, and after the patient is immersed add cold water or ice until the temperature of the water is *reduced to 80° F.* In all a bath should last about three minutes, not longer than five minutes. It is important to watch the pulse while the child is in the bath. The temperature should be taken before and about ten minutes after the bath to note the fever. We can then see what effect has been produced. Such baths may be repeated in three, four, or six hours, depending on the individual requirements.

An ice-cap may be placed on the head after the bath.

The treatment of fever is of the greatest importance. When there is stupor, drowsiness, and delirium, the tepid bath will be indicated. Cold packs and cold sponging are also valuable. Antipyrine, phenacetine, and quinine are extolled by some and condemned by others. When used they should always be combined with musk or camphor, or given with coffee to counteract the well-known cardiac depression caused by the antipyretics belonging to the coal-tar series.

In the treatment of high temperature in scarlatina and infectious diseases, injections of sulpho-carbolate of soda, 10 grains to a pint of cool water (temperature, 70° F.), is one of the best means of reducing fever. These injections should be repeated every three or four hours.

"High post-eruptive temperatures are often and have been repeatedly traceable to infelicities of ingestion and digestion, and are more effectively relieved by prompt and sufficient enemas than by any other treatment These high post-eruptive temperatures repeatedly arising in the same individual have been accompanied synchronously by sensible increase of submaxillary swelling and tenderness, followed by the quick abatement of these lymphatic swellings along with the reduction of temperature from cooling antiseptic enemas."

CHAPTER X.

ERYTHEMA INFECTIOSUM.[1] (DUKE'S DISEASE—FOURTH DISEASE.)

THIS is a feebly contagious disease with very slight subjective symptoms, and characterized by a "maculo-papular rose-red rash, more pronounced on the cheeks, legs, and outer surface of the arms. The specific agent is unknown. The disease occurs in epidemics, and often follows an outbreak of measles or rötheln. It is found to spread through families, and a number of cases have been observed at the same time in schools and kindergartens. It is undoubtedly carried by contagion, but it is not so contagious as the other exanthemata."

Children between the ages of 4 and 12 are mostly affected, although infants and adults may also be infected. The disease is seen in both sexes and occurs mostly in spring and summer. *The period of incubation* is from 6 to 14 days.

Symptoms.—"The disease may be ushered in by a slight feeling of malaise, weakness, and sore throat, but in the majority of cases the first symptom noticed is the eruption. This is the most important and often the only symptom. It appears invariably on the external skin, and no constant changes on the mucous membranes have been observed. A diagnostic feature of the disease is the character of the rash on the face, where it first makes its appearance. The cheeks are chiefly affected, and present a symmetrical rose-red efflorescence. The skin is hot to the touch, and is swollen, but it is not at all sensitive and does not itch. The color disappears on pressure, but quickly reappears. The whole appearance is suggestive of erysipelas. The eruption is confluent over the cheeks, and the edges are well defined, slightly raised, and distinct from the normal skin, but it may gradually fade on to normal skin. The area of confluent eruption is rather sharply limited in front by the nasolabial folds, and above by the temples. Laterally it extends to the angles of the jaws. The skin around the mouth appears pale in contrast to the livid hue of the cheeks. Discrete spots, varying in size from a pea to a hazel-nut, are often seen on the forehead and chin. The rash fades from the face after four or five days. About the second day the eruption makes its appearance on the body, where it is most marked on the outer surface of the arms and legs. The trunk is involved to a much less degree, and may be almost free, but in no case is the rash so intense as on the face and extremities. The eruption spreads toward the periphery, and the hands and feet are the last portions of the body to be affected. On the extremities the exanthem is typical and characteristic. It is morbilliform in appearance, and not so deeply rose-red as on the face. The contour of the eruption presents frequently almost geographical outlines, and in many cases the appearance is suggestive of lacework, especially as it begins to fade at the end of the disease. On the inner or flexor surface of the arms the eruption is not nearly so intense. It is apt to become confluent around the outer surface of the elbow. On the legs the eruption is similar to that on the arms, and it is always especially well marked on the buttocks. The trunk remains comparatively free from eruption, although a number of discrete spots, sometimes crescentic in form, can be seen sparsely scattered over the chest and back. The rash is more macular than papular, and shows only a slight elevation, except on the face, where it is always raised. An evanescence is often observed which is perhaps peculiar to this disease. The rash will apparently disappear when some slight irritation of the skin, such as friction, exposure to cold, etc., will bring it out again in full bloom. The eruption is not followed by desquamation. It lasts from six to ten days, and does not leave any stains or markings such as are sometimes seen after measles. No hæmorrhage results on pinching the skin as occurs in measles and scarlet fever. The lymphatic glands are not enlarged as a result or accompaniment of this disease.

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[1] I am indebted to Shaw's article published in the American Journal of the Medical Sciences, January, 1905, for many valuable points in this article.

"The subjective symptoms are conspicuous by their absence. The tongue may be slightly coated, but it never presents the strawberry appearance and desquamation of scarlet fever. The conjunctivæ are not congested, and there is no coryza or cough. The urine is normal."

The prognosis is excellent and no complication or sequelæ have been observed.

The treatment is symptomatic throughout.

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CHAPTER XI.

VARICELLA (CHICKEN-POX).

VARICELLA is a specific infectious disease of an acute character. The eruption consists of vesicles which appear in successive crops. The attack lasts in all from four to fourteen days. After one attack the child is usually immune during the rest of its life.

Etiology.—This disease is seen only in young children; the older the child the less liable it is to have chicken-pox. Nurslings are frequently afflicted.

Hutchinson states that in his experience adults are almost absolutely immune from this disease. In my own practice the majority of cases seen by me have been in children between the second and tenth years of age.

Pathology.—The pathological lesions are confined wholly to the epidermis. "The vesicles contain granular fibrin, a moderate cellular exudate, cellular *débris,* and serum; this differs markedly from the exudate in variola, which is usually very rich in cells, especially plasma cells. The pock in varicella is shallow, rarely involving the papillæ of the cutis, and as its contents are absorbed, the superficial covering is cast off in the form of a brownish scab, sometimes with marked pigmentation, but no resulting scar. The occurrence of a scar following the varicella lesion is occasionally seen."

Diagnosis.—The distinguishing features of varicella are: "*(a)* Its mild prodromal symptoms, which may be wholly absent. *(b)* The appearance of the eruption on the trunk, where it is usually more abundant than on the face and hands. *(c)* The multiform character of the eruption, its superficial position, comparable to drops of water sprinkled over the skin, and its appearance on the same region in successive crops. *(d)* Its mild constitutional symptoms and short duration; the disease usually terminates within from five to fourteen days. *(e)* Varicella is mildly infectious and always gives rise to a like disease."

A nursing infant, about five months old, refused the breast, and seemed to show a general malaise. The infant had previously enjoyed good health. The nursing was regularly carried out and the bowels were normal. The temperature was 100° F. There was no cough. On the second day of this malaise several vesicles appeared on the abdomen and back. Later, some vesicles appeared on the buttocks, thighs, and in the roof of the mouth. There was no constitutional disturbance and on the third day of illness the infant again nursed as usual. Several successive crops appeared, and each eruption remained about three days. Local treatment consisted in dusting the parts with cornstarch. Bathing was prohibited and small doses of calomel were given. No complications followed.

Differential Diagnosis.—This disease may be confounded with variola, as some mild cases of variola resemble chicken-pox. "The superficial strata of the epidermis are principally involved, and a serous exudate, which is frequently the first symptom of the disease, occurs at this point, resulting in a transparent, thin-walled vesicle, while in variola the shot-like, deep-seated induration and subsequent vesicular formation are sufficiently distinctive to warrant a differential diagnosis. The lesions in varicella, as a consequence, are easily destroyed, and when seen present a transparent, beady appearance, some of which, having ruptured, leave excoriated areas; whereas in variola it is impossible to rupture the lesions so as to evacuate the entire contents without numerous punctures or by totally destroying the diseased area."

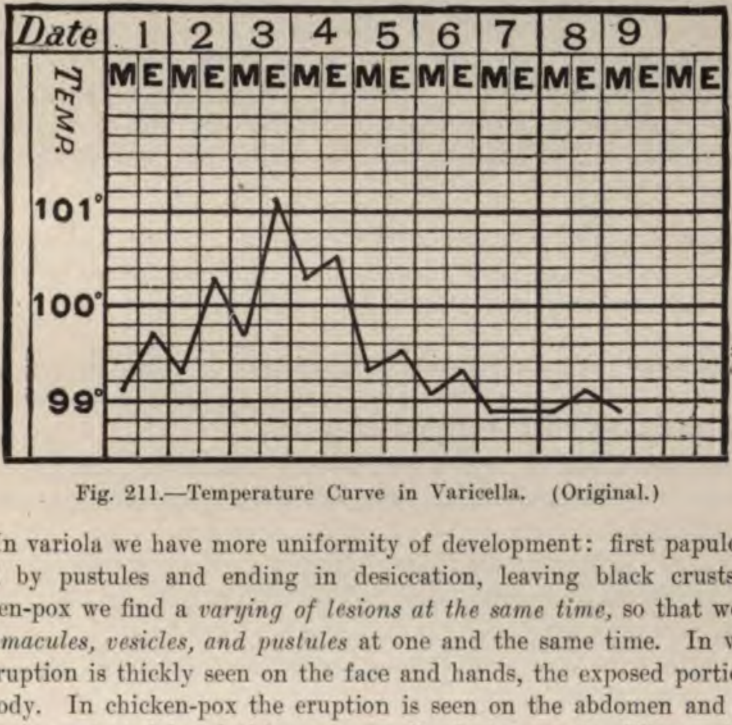

Fig. 211.—Temperature Curve in Varicella. (Original.)

In variola we have more uniformity of development: first papules followed by pustules and ending in desiccation, leaving black crusts. In chicken-pox we find a *varying of lesions at the same time,* so that we may have *macules, vesicles, and pustules* at one and the same time. In variola the eruption is thickly seen on the face and hands, the exposed portions of the body. In chicken-pox the eruption is seen on the abdomen and back; the parts protected by clothing are usually first covered. When called to doubtful cases the following points are worth noting:—

Umbilication is seen in smallpox; it is *absent* in chicken-pox. "The length of time since vaccination, and whether or not the patient has ever had chicken-pox. Smallpox is extremely seldom encountered within three or four years after vaccination, while after that time the number of cases of varioloid or abortive smallpox steadily increases. Chicken-pox, like smallpox, occurs but once in the same individual. Prodromal symptoms are always present for several days, usually three, in variola; absent or of a few hours' duration in varicella.

"The temperature often renders valuable aid in differentiating between the two diseases. In variola it rises rapidly, and even in mild or abortive cases usually reaches 103° to 104° F., when, on the appearance of the rash, a crisis takes place and it falls to the normal within a few hours, where it may remain throughout the remainder of the disease. Varicella, on the contrary, is seldom ushered in with fever, but the temperature usually rises one or more degrees as the eruption develops. When the case is seen for the first time after the eruption has appeared and, as often occurs, no definite history can be obtained, other symptoms must be relied upon."

Varicella may also resemble impetigo. Impetigo is first seen on the face, especially about the mouth and nose. It is also seen on the hands. In studying the regional appearance of the eruption one can readily see the transmission and inoculation from face to hands and *vice versâ*. This condition is never met with in chicken-pox. Impetigo may last weeks and months. Chicken-pox rarely exists more than two weeks. Impetigo is contagious and not infectious. Chicken-pox has been successfully inoculated.

Prognosis.—The prognosis is invariably good. I have never heard of a fatal case of chicken-pox. Complications should, however, be guarded against and not invited by carelessness.

Treatment.—A child suffering with chicken-pox should be put to bed and strictly isolated. Healthy children should not come in contact with a case of chicken-pox for at least two weeks.

The diet should be liquid, and feeding should be given at regular intervals. The bowels should be loose, and if necessary stimulated by the aid of a laxative.

For the eruption flannels and woolens should be avoided, and a cool, loosely fitting linen or muslin shirt or gown should be worn. It is safe to prohibit the daily bath until the eruption has disappeared. I prefer to dust the skin with some bland dusting powder such as talcum, corn starch, or rice powder several times a day. Iron and tonics may be given later if required. Locally, a paste made by mixing bicarbonate of soda with cold water and applied to the chicken-pox is cooling.

Baby B., five months old, was attended by me in January, 1905. The infant had a severe form of varicella with gastric disturbances, such as vomiting and diarrhœa. On the sixth day after the appearance of the chicken-pox the infant scratched its arm. On the following day there was a temperature of 102° and a diffuse swelling surrounded the upper arm. There was marked tenderness and pain on the slightest motion. The swelling increased. The arm became reddened and a diffuse erysipelas was diagnosed. The temperature increased to $105\,^{8}/_{10}$°. The case was then seen by Dr. A. Jacobi in consultation.

Treatment.—Local treatment consisting of evaporating cooling lotions; lead and opium wash and bichloride were used without any marked benefit. Crede ointment was rubbed into the axillary glands several times a day. An injection of 10 cubic centimeters of antistreptococcus serum (Aronson) seemed to have very good effect. The cooling lotions were continued, but within twenty-four hours after the serum injection the temperature came down by lysis and after four days the temperature was normal. The case recovered.

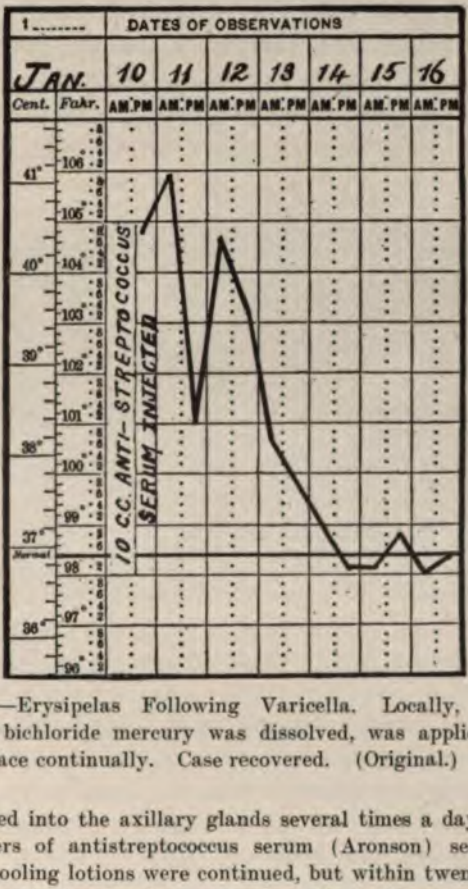

Fig. 212.—Erysipelas Following Varicella. Locally, pure alcohol, in which $^{1}/_{2000}$ bichloride mercury was dissolved, was applied on the erysipelatous surface continually. Case recovered. (Original.)

CHAPTER XII.

VARIOLA (SMALLPOX).

This acute infectious and contagious disease is frequently seen in unvaccinated children. It is rarely met with in children that have been properly vaccinated. I have seen smallpox in very young infants and children *that were unvaccinated during my service at the Riverside Hospital* in the summer of 1902.

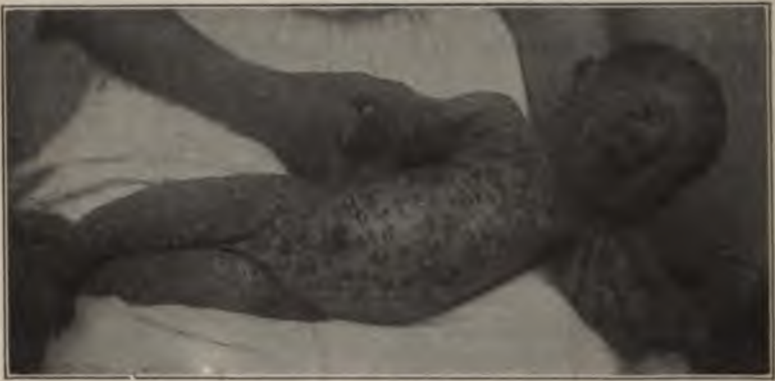

Fig. 213.—Fatal Smallpox in an Unvaccinated Four-weeks-old Infant. Seventh day of eruption. (Kindness of Dr. J. F. Schamberg.)

Etiology.—The etiological factor, most likely a specific micro-organism, has not yet been found.

Among unvaccinated children between 1 and 10 years of age, some authors state that 58 per cent. die. During the Sheffield epidemic, of 2892 unvaccinated children under 10 years of age living in infected

Table No. 91.—*Showing Number of Cases, and Percentage of Mortality (Allbutt's System)*

	Unvaccinated.			Vaccinated.		
	Cases.	Deaths.	Mortality Per cent.	Cases.	Deaths.	Mortality Per cent.
Under 5 years	1131	647	57.2	385	30	7.8
5 to 9 years	952	385	40.4	1468	59	4.0
10 to 14 years	607	155	25.5	3080	90	2.9
Totals	2690	1187	41.3	4933	179	4.9

houses, 7.8 per cent. were attacked. During the Warrington epidemic 54.5 per cent. of unvaccinated children under 10 years of age were attacked.

It is a curious fact that the resistance of children is less than that of adults. Nursing infants frequently have mouth, nose, and throat complications, which seriously interfere with their feeding, causing death.

There are three types of variola:—

TABLE No. 92.

1. Natural	Discrete	Discrete when the eruption is scattered.
	Confluent	Confluent when the eruption is thick and flows together.
	Semi-confluent	Semi-confluent when the eruption is discrete in some parts and confluent in others.
2. Hæmorrhagic	Purpuric	
	Hæmorrhagic	
	Exudative	
3. Modified.	Anomalous	
	Corymbose	Corymbose when the eruption forms groups or clusters on various parts of the body.

The mode of infection is most probably a micro-organism which exists either in the vesicles, pustules, or crusts. It may be carried in the air so that infection may take place at some distance from the body. Some authors believe that the blood of smallpox patients contains the poison. Smallpox can be transmitted directly from person to person. It can also be transmitted from bedding or clothing worn by an infected person. *Entering a room* during the pustular and desquamative stages is sufficient to communicate the disease.

Symptoms.—In young children the disease is usually ushered in with convulsions. The pulse-rate ranges between 130 and 160. The respiration is labored and increased in frequency.

Curschmann believes that these symptoms are due to an irritation of the respiratory centers.

The *temperature* rises rapidly and continuously *without* the morning remission. Beginning with 102° or 103° F. on the first day of illness, the temperature soon reaches 105° F. (40.5° C.) until the eruption appears.

With the first appearance of the eruption, the temperature frequently drops to normal. *This symptom of fever occurs in no other exanthematous eruption.*

The Eruption.—"Reddish specks or dots developed into papules resembling flea-bites appear about the second day. After the papules have attained the size of a small pea their summits gradually assume a translucent glazed appearance which indicates the formation of a vesicle. As this enlarges a central depression or umbilication takes place which is looked upon as characteristic of the smallpox lesion. If punctured a small amount of mucilaginous serum exudes. The eruption is not confined to the skin, but is met with in the mucous membrane on the mouth, throat, and nose.

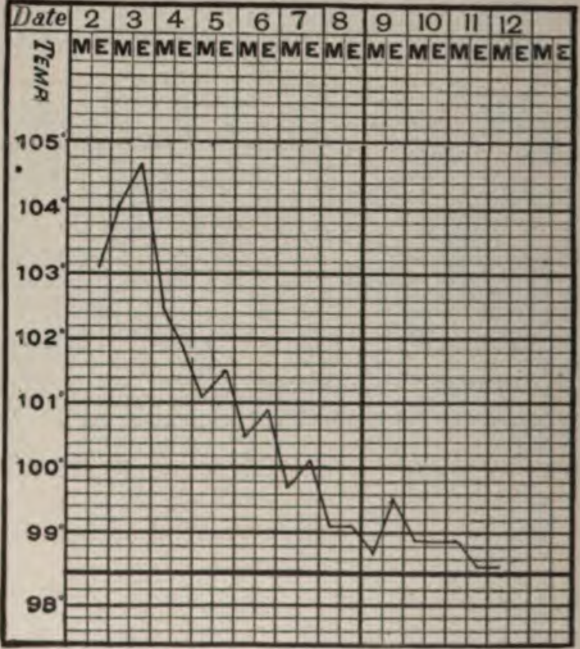

Fig. 214—Temperature Curve in Variola. (Original.)

Stage of Suppuration.—On the sixth day of the eruption there is a decided yellowish tint, due to the presence of pus cells or polymorphonuclear leucocytes resembling cream. The face usually presents an erysipelatous redness.

Stage of Decline.—About the twelfth day of the eruption there is a spontaneous rupture of the pustules. After the contents are thus evacuated, or by absorption, we see *evidences of desiccation.* The pustular contents dry up and the pustule dies, leaving a blackish crust. These blackish or brownish crusts appear first where the eruption took place. We therefore first note this condition on the arms, palms, and soles. The crusts separate from the body between the sixteenth and twenty-first days.

Desquamation of a furfuraceous character takes place, lasting from one to two weeks. After this condition has disappeared the patient may be regarded as cured.

Differential Diagnosis.—Corlett describes the great resemblance of smallpox to typhoid fever in its early stages, in a case seen by him. A strong Widal reaction was found, besides a bronchitis.

Measles frequently resembles smallpox. Catarrhal symptoms always present in measles are absent in smallpox. The lesions in measles are flat, soft, and velvety to the touch. The papules of smallpox are small and feel like shot imbedded in the skin.

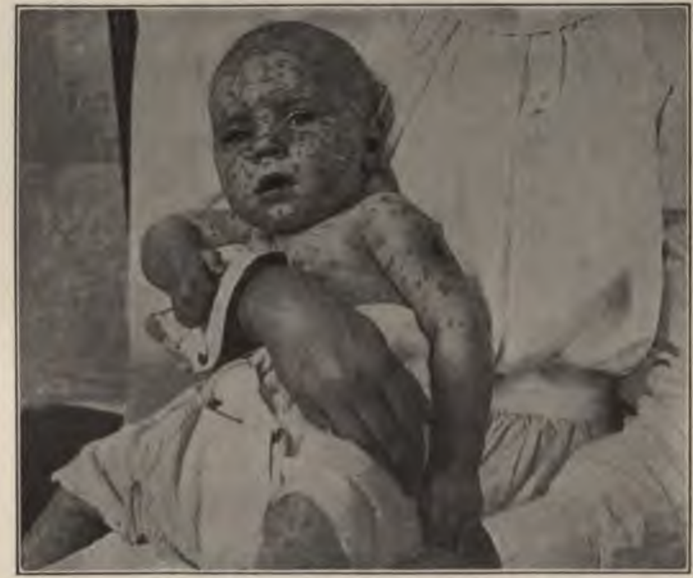

Fig. 215.—Smallpox in a Child that was Vaccinated During the Incubation Period. Vaccination performed five days before the appearance of the variolous eruption. Little or no modification. (Kindness of Dr. J. F. Schamberg.)

Scarlet fever sometimes resembles variola of a mild form. The premonitory symptoms of variola are very severe, and last two or three days, whereas those of scarlet fever are mild, last a few hours, and not infrequently are entirely overlooked. The rash in scarlet fever appears on the upper part of the body, chest, cheeks, and neck. In variola a scarlatinal form of eruption is seen on the lower part of the abdomen and on the inner surface of the thighs. It is bright and fiery red in scarlet fever and dull red in variola. The conspicuous papillæ or strawberry tongue is present in scarlet fever and absent in smallpox.

Impetigo is frequently mistaken for smallpox. Corlett describes the presence of supposed impetigo in Ohio in 1898 which gave rise later on

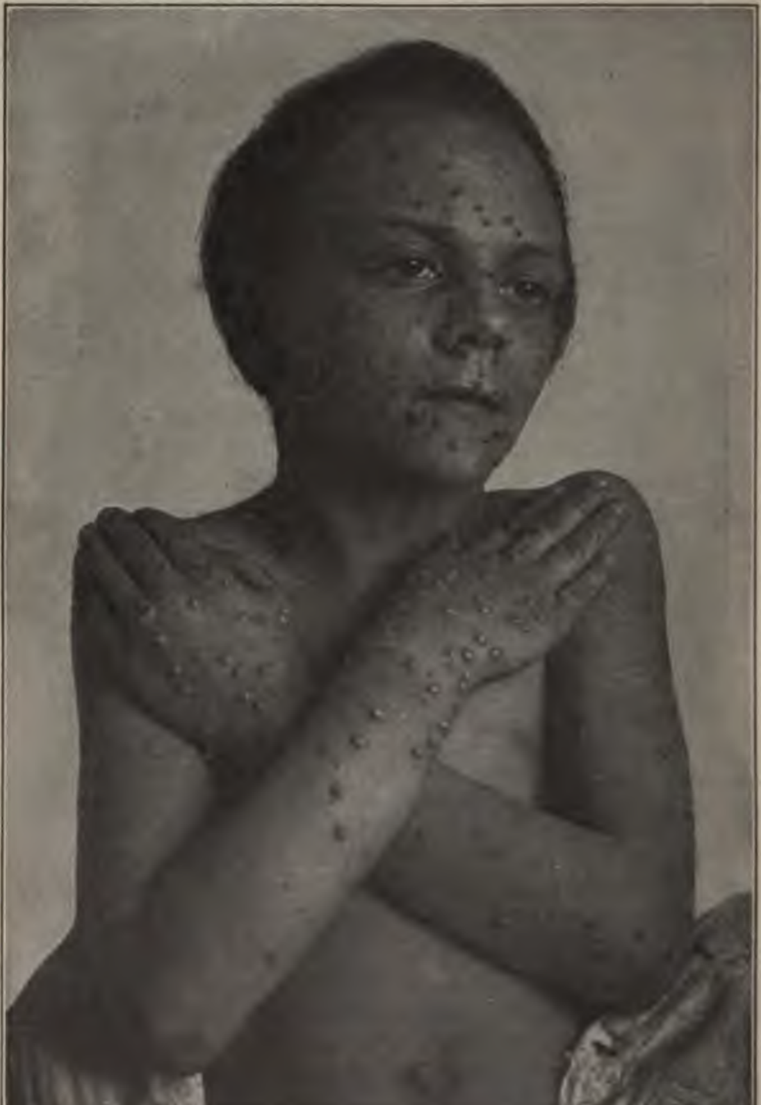

Fig. 216.—Mild Discrete Smallpox in an Unvaccinated Girl. Note absence of lesions upon the trunk. (Kindness of Dr. J. F. Schamberg.)

to an epidemic of smallpox. Thus it is apparent that there is a great resemblance between impetigo and smallpox, and *vice versâ.*

Chicken-pox is frequently mistaken for smallpox. I have already outlined the differential points in describing chicken-pox (see chapter on "Varicella").

Syphilis may sometimes be mistaken for variola. A study of the temperature and pulse and careful observation for several days will usually clear up the diagnosis. In variola the eruption assumes a pustular character on the palms and soles.

The Prognosis and Course are always bad in unvaccinated children, especially in the very young. In the vaccinated the prognosis is always good.

A series of cases was seen by me, during the summer of 1902, in the smallpox wards of the North Brothers' Island Hospital. Out of twelve children seen not one had been vaccinated. One child was infected by its mother.

As a rule the course extends over three weeks, rarely lasting four weeks. Complications of the nose, mouth, and throat of a catarrhal nature are occasionally seen. The outcome of the cases seen by me was quite good in spite of the severe character of the disease.

Complications.—Swelling of the mucous membrane, such as œdema of the glottis, bronchitis, and broncho-pneumonia, frequently complicates variola. The eruption plus secretion, when present in the throat, are the cause of great irritation, and give rise to a hacking cough. Suffocatory symptoms may follow œdema of the glottis. Otitis of a purulent nature is frequently seen. It is usually accompanied by severe neuralgic pains.

Treatment.—The best sanitary surroundings, fresh air, and the shortest possible isolation are advisable. The local application of a solution of glycerine and carbolic acid will tend to relieve the itching, and to soften the crusts.

The bowels should be kept thoroughly cleansed, and the patient made comfortable by a tepid pack if the temperature is high or if delirium is present. An ice-cap and cold colon flushing will render the patient more comfortable. If cardiac depression exists, stimulation with musk, camphor, or champagne is advisable. Regarding sanitary measures the New York Health Department requires the immediate removal of a case of this kind to the smallpox hospital. The disinfection and thorough fumigation of everything which was in contact with the case must be remembered if we wish to prevent the spread of the disease.

VARIOLOID (MODIFIED SMALLPOX).

The symptoms are milder, the papules less in number, and the general condition shows an infection of a lesser type than we see in variola.

The febrile symptoms may be the same as we see in true smallpox. The attack is shorter. The severity of the symptoms depends on the length of time since the last vaccination took place.

VACCINATION.

Jenner noticed that milkmaids in Gloucestershire, England, who were inoculated with cow-pox, became immune to smallpox.

In 1798 he published this discovery and gave the world the benefit of the protective value of vaccination against smallpox.

The serum taken from a vesicle of a calf which has vaccinia or cow-pox contains protective properties when transported to living beings. When a child is inoculated this same immunity can be transferred. All infants over six months of age should be vaccinated. When smallpox exists in the locality, then infants of any age should be inoculated to avoid infection. The nursing infant is not exempt from smallpox, as I have seen several cases, in very young infants, in the wards of the Riverside Hospital. When infants are robust and in good health there can be no contraindication to their being vaccinated. Regarding older children that have been vaccinated, it is safe to revaccinate once every five years.

Symptoms.—From five to ten days after inoculation a red areola is seen around the wound. Inflammatory symptoms are marked. The neighboring lymph glands are swollen.

Constitutional symptoms such as fever, anorexia, general malaise, and thirst are noted. This condition lasts usually from two to three days, rarely longer, unless some complication follows.

The complications are erysipelas and cellulitis. Abscesses are usually the result of carelessness or infection. This infection usually takes place at the time of inoculation or may result from dirt or scratching with dirty nails or other filthy habits. (Read article on "Varicella.")

Syphilis and tuberculosis are frequently mentioned as accidental infections, but I have never seen or heard of a *bona fide* case resulting from vaccination.

Varieties of Vaccine.—(*a*) Humanized; (*b*) bovine.

Humanized vaccine is rarely or never used. By using human virus the chance of conveying syphilis or other disease has been thought possible. Therefore, the bovine virus has been given preference.

Where to Inoculate.—Usually on the arm, although the leg is sometimes preferred for females.

Arm.—The upper third of the arm is the part usually chosen.

Leg.—When preference is shown for vaccination on the leg in female infants, the lower anterior outer third of the leg should be chosen.

Good vaccine virus will take on almost any part of the body.

Fig. 217 shows a case of vaccination which I reported in *Pediatrics*. The child was vaccinated on the arm and after scratching the same she carried some of the virus from the arm to the cheek, causing a successful vaccination.

Method of Inoculation.—The parts to be inoculated should be cleaned with soap and water; also the operator's hands. After thorough drying of the parts with cotton, a sterile needle should be used for scarification. A small square should be scratched crosswise, but no blood should be drawn.

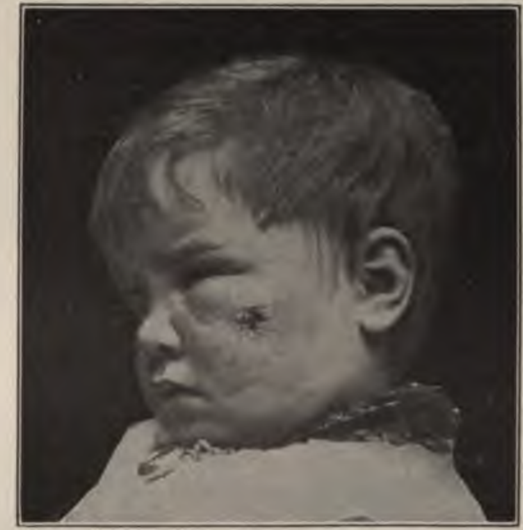

Fig. 217.—Accidental Vaccination on the Cheek. Showing successful vesicles and pustules, marked inflammation and œdema of the lower eyelid. Permanent scar. (Original.)

No antiseptic should be used to clean the part to be vaccinated, otherwise we destroy the vaccine virus.

Glycerinized Lymph.—When using capillary tubes, break off the ends and blow the virus on the scarified area. See that it is well rubbed into the scarified area and allowed to dry. When dry protect the part with a shield or a sterilized gauze dressing.

Ivory Points.—When using ivory points the point is dipped into sterile water after it has scarified the area to be inoculated. The moistened serum should then be thoroughly rubbed in and allowed to dry. The parts are then to be protected against infection as already described.

Welch and Schamberg, in a series of cases,[1] call particular attention to the great difference in the death-rate between the vaccinated and the unvaccinated patients. Those who were vaccinated in infancy and showed good scars gave the remarkably low death-rate of 2.61 per cent. as against the high death-rate of 28.17 per cent. in the unvaccinated. There is no doubt that all those who showed either good or fair scars were successfully vaccinated in infancy. If we consider them together, therefore, the death-rate is 4.84 per cent. In making a comparison between the vaccinated and unvaccinated cases, it is scarcely fair to include as vaccinated all the cases showing poor scars, as very many of them doubtless were never successfully vaccinated.

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[1] Therapeutic Gazette, June 15, 1902.

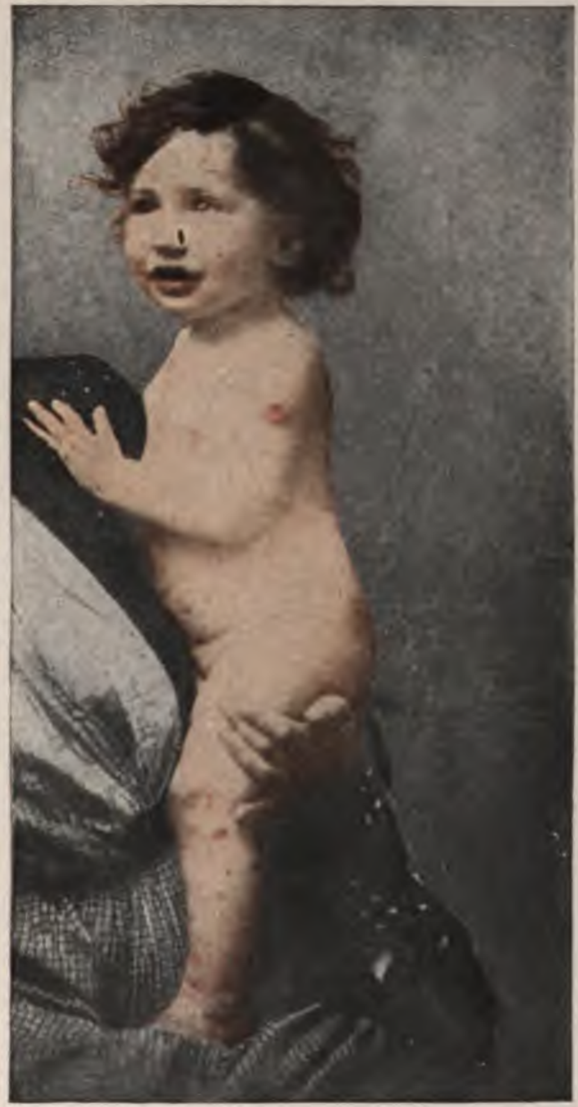
Patients who had been vaccinated seven days, or less than seven days, before the appearance of the eruption of smallpox, gave a death-rate of 35.71 per cent., while those who had been vaccinated for a longer period than seven days before the outbreak of the efflorescence, gave a death-rate of only 14.28 per cent.

VACCINIA.

This acute condition is characterized by an eruption following the inoculation of lymph. When lymph is taken from a seropurulent eruption on the teat or udder of a cow, it is called cow-pox. Some authors believe that vaccinia is a modified form of smallpox.

Symptoms.—An eruption resembling measles or scarlet fever sometimes follows vaccination. It usually involves the arms, neck, and chest; in rare cases it involves the whole body. It most commonly occurs between the eighth and eleventh days after vaccination. The temperature is rarely above normal and there is no constitutional disturbance. There is no treatment excepting cleanliness. Internally, a mild laxative may be given.

PLATE XVIII



Vaccinia Following Vaccination. Note a roseola extending over the left arm and leg, also the face and abdomen. There were no constitutional disturbances. The rash appeared between the seventh and eighth days after the vaccination. It lasted two days. (Original.)

CHAPTER XIII.

TYPHOID FEVER.

TYPHOID FEVER is an acute infectious disease caused by the invasion of a specific micro-organism, known as Eberth's typhoid bacillus.

Etiology.—Typhoid is rarely seen in infants. It is most frequently seen in children over 5 years of age. In a series of 97 cases described by Henoch:—

2 cases occurred during the 1st year
21 cases between the 2d and 5th years
59 cases between the 5th and 10th years

Von Steffens in a series of 148 cases reports:—

2 cases occurred during the 1st year
28 cases between the 3d and 6th years
34 cases between the 6th and 9th years

I have seen typhoid fever in an infant 1 year old which was infected by its mother.

Baginsky describes an epidemic of typhoid seen by him in Germany, in which 16 cases were under 10 years of age.

Infected water and infected milk appear to have caused this disease more than any other factor. Baginsky mentions flies as an occasional source of infection.

The New York Health Department, in a circular of information concerning the urine in typhoid fever, directs attention to the fact that "the typhoid bacilli are present in almost incredible numbers, estimated at many millions per cubic centimeter."

These germs find a suitable culture medium for their propagation in the intestinal tract. They are very easily found in the fæces in the living state during the height of the disease.

The entrance of the typhoid bacillus into the gastro-intestinal tract, whether it is in food, liquid or solid, is responsible for the disease. It is true that a receptive condition may exist. A child having had a series of gastro-intestinal attacks is more liable to an infection than one whose digestive tract is normal. Rickets and a general debilitated condition certainly favor the development of typhoid.

Typhoid fever occurs most frequently in the fall of the year. I have seen more cases of typhoid in children during September and October than during the rest of the year. During the fall and winter of 1902 and 1903 some of the worst cases of typhoid with hæmorrhages occurred.

Bacteriology.—The typhoid bacillus resembles the bacillus coli communis, and is found chiefly in the lymphoid tissue of the small intestines, especially in Peyer's patches, where it produces a specific inflammation. The bacillus is found not only within the intestines, but in the glands as well. Neuhaus found the bacillus by puncturing the roseolar eruption and examining the blood therein. It has also been found in laryngeal

TABLE NO. 93.—*Deaths from Typhoid Fever in Children Under 15 Years of Age—Old City of New York.*

			0 Years.	1 Year.	2 Years.	3 Years.	4 Years.	Under 5 Years.	5 to 10 Years.	10 to 15 Years.
1890	Males	27	1	2	1	4		8	9	10
	Females	27		2		1	3	6	8	13
1891	Males	34	1	3	1	5	3	13	12	9
	Females	42	1	2	5	2	1	11	14	17
1892	Males	37	1	4	2	4	1	12	10	15
	Females	25	2	2		1	1	6	14	5
1893	Males	24	1	2	2	2		7	12	5
	Females	19		2		1	3	6	7	6
1894	Males	25	2	1	1	1		5	9	11
	Females	24	1	1	2		1	5	6	13
1895	Males	24	2	3			3	8	6	10
	Females	18		1		3		4	6	8
1896	Males	29	2		1	3	3	9	11	9
	Females	27	2		2		1	5	13	9
1897	Males	17			2	2	1	5	7	5
	Females	28	2	2	1	4		9	9	10
1898	Males	32		1	1	2	1	5	9	18
	Females	17		1		2	1	4	7	6
1899	Males	13		1		1	1	3	3	7
	Females	18			1		1	2	8	8
1900	Males	30	2	2	2	1	2	9	11	10
	Females	19		2	1	2	3	8	6	5
1901	Males	25		3	2	2	4	11	6	8
	Females	28	1	1	1	2	4	9	4	15
	Total	500	21	38	28	45	38	70	201	232

ulcerations during typhoid. The bacillus was also found in the purulent meningitis accompanying typhoid, so that we can be reasonably certain that the bacillus abounds in almost every part of the body. The action of typhoid bacillus on the human system is toxic. Brieger isolated a poison from the typhoid bacillus, which is called the typhotoxin.

Pathology.—The pathological findings consist in an inflammatory condition of the mesenteric glands; besides these the solitary and agminated glands of the ileum and colon not only show evidences of swelling, but when the disease progresses it frequently terminates in ulceration and necrosis.

Occasionally the glands will show a softening and pus will develop. The spleen is usually very large and soft, and quite palpable. When the disease lasts several weeks and there are evidences of a distinct toxæmia, the poison will cause a marked degeneration of the kidneys and liver, also affecting the heart muscles, which, later, will be found very soft and flabby.

Morse[1] reports several cases of *fœtal* and *infantile typhoid.*

Fœtal and Infantile Typhoid.—In regard to fœtal typhoid he says that the typhoid bacillus can transverse the abnormal, and possibly the normal placenta from mother to fœtus. Other organisms may also pass in the same way.

Infection of the fœtus results. Because of the direct entrance of the bacilli into the circulation, intrauterine typhoid is from the first a general septicæmia. For this reason, and possibly also because the intestines are not functionating, the classical lesions of intrauterine typhoid are wanting.

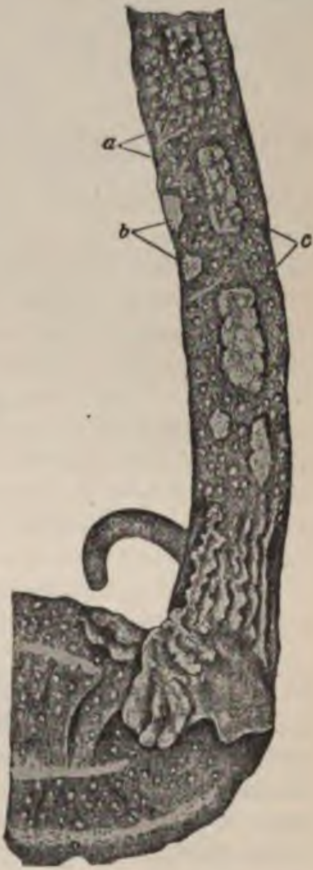


Fig. 218.—Typhoid Infantum in a 2-Year-Old Boy. *(a)* Solitary follicle; *(b)* small agminated gland; *(c)* Peyer's patch. General medullary infiltration, no ulceration. Natural size. (Langerhans.)

The fœtus usually dies in utero or at birth as the result of the typhoid infection.

It may be born alive but feeble and suffering from the infection. If so, death occurs in a few days without definite symptoms.

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[1] Archives of Pediatrics for December, 1900.

It is possible that the fœtus may pass through the infection in utero and be born alive and well. There is, however, no proof that this happens.

Infection does not always occur. The pregnant woman does not necessarily transmit the disease to her child.

As to infantile typhoid Morse concludes that except for the lessened exposure in the first year through food there seems no obvious reason why typhoid should be less frequent in infancy than in later life. Nevertheless, judging from the small number of cases reported, it is less frequent. It may really be less frequent, or only apparently so because the disease is not recognized, being mistaken for other conditions. Bacteriological examinations in large series of autopsies on infants and the use of the Widal serum test in large numbers of sick babies seem to offer the best means for determining both the frequency and the character of the disease at this age.

The accuracy of the diagnosis in many of the earlier reported cases must be regarded as very doubtful, and hence no satisfactory conclusions can be drawn from them. Analysis of the more recent and certain cases seems to show that the symptoms of infantile typhoid are essentially the same as in adults, but that the course is shorter and the mortality greater. These conclusions may be inaccurate, however, as it is possible that they are based on the severe cases alone, the milder cases having escaped notice. The pathological changes in the intestines are, as a rule, insignificant. The contrast between them and the severity of the general symptoms is striking. The probable explanation is that in the infant as in the fœtus, but to a less degree, the disease is a general rather than a local infection.

The serum reaction occurs in infantile as in adult typhoid. There are no data as to whether or not it occurs in fœtal typhoid.

Immunity.—The agglutinating power may or may not be present in the blood of infants born of a woman with typhoid. If present, it is transmitted from the mother to the child through the placenta. It is possible, however, that it may be formed in the child in response to toxins transmitted through the placenta. The agglutinating principle can pass through the normal placenta. Part of it, however, is arrested in the passage. Whether or not it is transmitted seems to depend on the strength of the agglutinating power in the maternal blood and the length of time during which the placenta is exposed to it.

It may be transmitted to the nursling through the milk. It may appear in the infant's blood in less than twenty-four hours. It lasts but a few days after the cessation of nursing. It is always weaker in the milk than in the maternal blood and always weaker in the infant's blood than in the milk. This weakening of the agglutinating power is due to the obstruction to its passage in the mammary gland and in the nursling's digestive tract. The chief factor governing transmission is the intensity of the power in the maternal blood. A subordinate but important factor is some unknown condition in the digestive tract. If the power in the maternal blood is weak and the obstacles great it may not be transmitted.

Symptoms.—The symptoms are usually very obscure in children. Vomiting and sometimes diarrhœa are the earliest symptoms. In other cases constipation may be an early symptom. The so-called pea-soup diarrhœa seen in adults and older children is rarely met with in young infants. Convulsions frequently usher in an attack of typhoid fever.

In older children, those able to complain will usually give subjective symptoms, which may aid materially in making the diagnosis. A constant headache, for example, will always show a severe form of infection, and may be the only symptom which will be constant.

The period of incubation varies from five to fourteen days. We can safely say it is rare for the period of incubation to extend over three weeks.

The Temperature.—The temperature is one of the main indications of typhoid. It rises at night and falls in the morning, the morning fall being less and the evening rise greater for the first week (step-laddder type) until the maximum is reached. The temperature shows fairly regular oscillations, morning fall and evening rise for about a week. It then returns to normal at the end of the third, sometimes at the end of the fourth or fifth week. The temperature drops by lysis, never by crisis.

Secondary fever is rare in children. It is not unusual to find a mild form of typhoid terminating normally at the end of two weeks.

During the second week of the disease when the temperature remains fairly constant, the diagnosis will be much easier, although a positive diagnosis from the temperature alone should not be made. The temperature in a mild form of typhoid in an infant varies between 101° and 103° F. during the first week, or even the second week, of the disease. Severe cases may show a temperature of 105° F., or even higher, during the first week of the illness. The temperature may show peculiar variations. We may have a sudden rise extending over a period of six weeks instead of three weeks. This prolonged pyrexia sometimes denotes complications. If the temperature has ranged between 103°, 104°, or 105° F., and suddenly drops to normal or subnormal, then we must suspect either an internal hæmorrhage or look for a perforation. Sudden variations in the temperature, as a very sudden rise or fall, must always be looked upon with suspicion. There is no crisis in typhoid as there is in pneumonia.

The Pulse.—The pulse is usually increased in frequency and ranges between 130 and 160 per minute. The force and rhythm are good unless some complication arises. The pulse is usually small and compressible, and there is very low tension in fatal forms of the disease.

The Tongue.—The tongue is coated with a whitish, more rarely a brownish, fur. This coating extends down the center, although the whole tongue may be covered. The mouth appears very dry, and the patient sometimes complains of intense thirst.

The abdomen is usually distended with gas and there is marked tympanites on percussion. Gurgling and tenderness on palpation in the ileocæcal region is not to be looked upon as an important symptom.

The Spleen.—The spleen cannot be relied upon as a diagnostic aid in children. While it may be enlarged in some instances, we frequently find that it is not palpable in many cases of severe typhoid.

Coughs and Bronchial Catarrh.—One of the earliest symptoms in typhoid is bronchitis. In the beginning when we have but cough and fever the diagnosis will be quite difficult. Typhoid frequently simulates pneumonia.

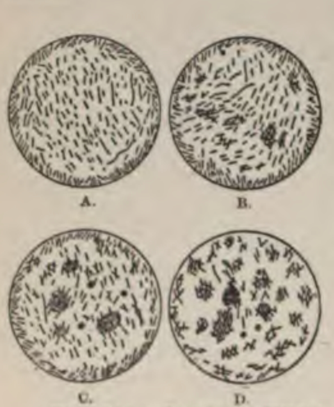

Fig. 219.—Stages in Widal Reaction. (After Robin.)

The Nervous System.—In profound toxicity the nervous symptoms present will be muttering, delirium, and a semi-comatose condition. Not infrequently rigidity of the muscles of the neck is present, so that the differential diagnosis from meningitis will be difficult. The nervous symptoms frequently resemble those seen in tubercular meningitis. Acute tuberculosis may sometimes resemble typhoid.

Extreme Emaciation. — Children frequently show emaciation during typhoid for the following reasons:—

1. The constant fever.
2. The low vitality owing to malnutrition.
3. The system being constantly drained when diarrhœa exists.

Diagnosis.—In every case of fever in which a diagnosis cannot be made, a drop of blood should be examined for the presence of the Widal reaction. This reaction is always a trustworthy evidence of the presence of typhoid, and a negative reaction later than the tenth day is strong but not absolutely convincing evidence of the absence of typhoid. The test is of greater value in the case of an infant than an adult, as we can exclude the occurrence of a previous attack. Some writers state that the reaction is seen earlier in children than in adults.

It should not, however, be the only means of making a diagnosis. It is well known that this reaction will occur months and sometimes years after the patient has recovered from typhoid, hence great caution should be used in relying on this diagnostic measure exclusively.

Widal Test for the Diagnosis of Typhoid Fever.[1]—The investigations of Grüber, Widal, and others, published in 1896, showed that the blood of persons, suffering from or having recently had typhoid fever, contains, as a rule, after the fifth day of the disease, substances which, when added to a broth culture of the typhoid bacilli, arrest the characteristic movements of these organisms and cause them to become clumped together in masses.

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[1] This method is described by the New York Health Department.

The results of a very large number of examinations made here in New York and elsewhere show, that if the blood contains agglutinating substances in sufficient amount to cause a prompt and marked reaction, when one part of serum or blood solution is added to 10 parts of a broth culture of the typhoid bacillus, the presence of a previous or existing typhoid infection may be considered as extremely probable, and that if these substances are present in such an amount as promptly to produce the reaction, when 1 part of serum or dried blood solution is added to 20 parts of the culture, the presence of a previous or existing typhoid infection may, for diagnostic purposes, be practically considered as established.

In estimating the diagnostic value of a negative result from this test, we must remember that the reaction is rarely, if ever, present until at least four days after the appearance of symptoms; that it is occasionally absent in cases of typhoid fever until the third or fourth week, or even until convalescence is established; that when developed it may disappear after a few days, and that no definite relation between the severity of the disease and the degree and time of development of the substances causing the reaction has been established. For these reasons a single negative result in any suspected case only renders doubtful the existence of typhoid fever. In those cases in which the reaction is absent after the ninth day, it may be reasonably assumed that the large majority will not prove to be typhoid fever, and the absence of the reaction in all of several different cases of a suspected group, or after repeated examinations in any single case, affords evidence of very decided value in excluding the diagnosis of typhoid fever.

Directions for Preparing Specimens of Blood.—The skin covering the tip of the finger is thoroughly cleansed and then pricked with a clean needle deeply enough to cause several drops of blood to exude. Two large drops are then placed on the glass slide, one near either end, and allowed to dry without being spread out on the surface of the slide. After they have dried, the slide is placed in the holder and returned in the addressed envelope to a culture station, or mailed to the laboratory.

The diazo reaction should be looked upon as a valuable aid in making the diagnosis. It is described in detail in the chapter on "Urine," page 923.

The Eruption.—The eruption consists of lenticular-shaped, rose-colored spots. They are small and slightly elevated. These rose-colored spots appear at the beginning of the second week. The eruption lasts about ten days, although the spots last from two to three days and are succeeded by a new crop. They are seen on the thorax and abdomen, although at times over the whole body.

Morse[1] studied 670 cases of typhoid and found the eruption in 60 per cent.

Differential Diagnosis.—*Malaria* frequently resembles typhoid. A differential diagnosis can easily be made by an examination of a drop of blood for the presence of plasmodia.

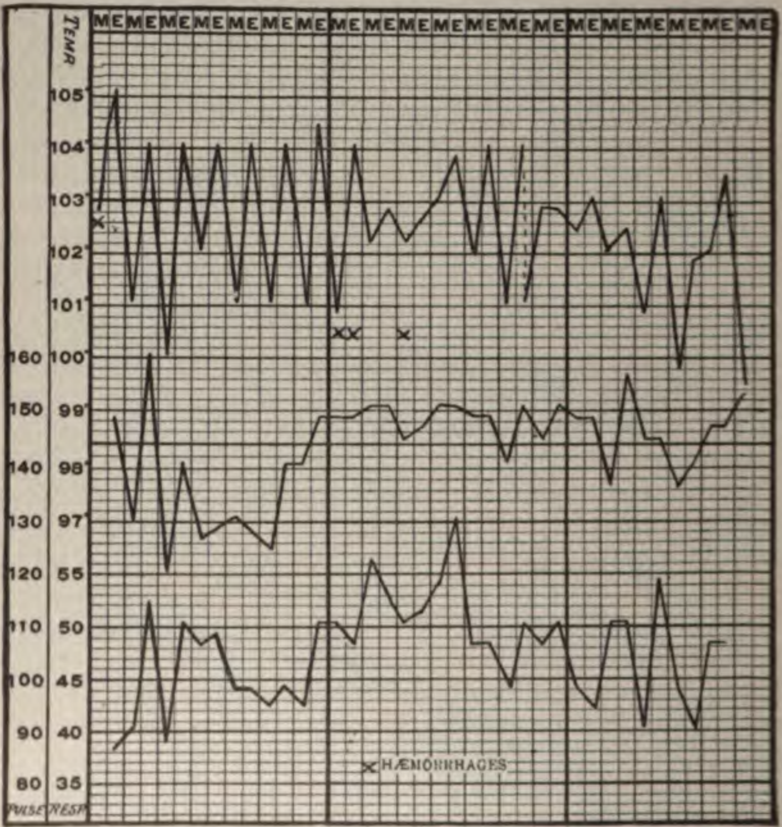

Fig. 220.—Typhoid Fever.—Severe hæmorrhages. Fatal result. (Original.)

The administration of quinine is a diagnostic test of practical importance. An *irregular or intermittent fever which yields promptly to quinine is certainly not typhoid.* In malaria, the temperature will be found to touch normal at some time in the twenty-four hours.

Cholera Infantum.—Many cases of supposed cholera infantum frequently prove to be typhoid fever. I have seen many cases in midsummer with a temperature of 102° F., having roseola, with vomiting and diarrhœa. In such cases the diagnosis depends on the presence of the Widal reaction.

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[1] Boston Medical and Surgical Journal, Feb. 27, 1896.

When diarrhœal symptoms and fever are present in the early stages of typhoid fever it is extremely difficult to make a diagnosis. This applies especially to the first week of the disease before a Widal reaction can be made. I have invariably examined the urine for the presence of indican (see page 925). When the symptoms are due to intestinal autointoxication or fermentative conditions in the intestine, then a positive indican reaction is present. If the diazo-reaction is absent and indican present, we can exclude typhoid fever.

Internal Hæmorrhages.—Holt reports a series of 946 collected cases in which hæmorrhage occurred in 30 cases, about 3 per cent. The majority of these cases were over 10 years of age. I have frequently seen hæmorrhages in children between 5 and 10 years; never under 5 years.

CASE I.—A case of typhoid in a boy 16 years old, seen in consultation with Dr. Rayewsky, had a series of hæmorrhages which ended fatally. The origin of this case was supposed to be an infection from eating raw oysters. The boy was a telegraph messenger and ate some oysters in the street, after which he showed signs of fever, and intestinal symptoms. No other etiological factor was ascertained. The boy was in good health and suddenly became ill after eating this meal of oysters. Symptoms of gastric fever, with diarrhœa; temperature of 101° to 103° F. gradually appeared. The symptoms increased from day to day until delirium and general coma were present. The fever was difficult to control in spite of cold tub bathing. The boy weakened from constant pyrexia—appeared to convalesce—when a severe hæmorrhage occurred. An ice-bag was laid over the abdomen, and opium given internally. The colon was flushed with alum and water. Nothing seemed to control the bleeding.

CASE II.—A girl, 10 years old, was seen in consultation with Dr. H. Weinstein. She had been sick about three weeks when seen by me. She was apparently convalescing when she had a hæmorrhage of a very alarming nature. The doctor told me the child lost more than one pint of blood. The pulse was about 130 and very feeble in character. The child was deathly pale and seemed to be in collapse. Whisky and strychnine were ordered as restoratives. The child complained of chills and was thoroughly wrapped in warm blankets and hot-water bottles were applied to her feet. A teaspoonful of powered alum added to a pint of cold water was injected into the rectum and colon. Paregoric in 15 drop doses was ordered every hour. The nurse was instructed to watch the pupils and the pulse and to discontinue the drug as soon as the systemic effect of the paregoric was manifested. Ice-cream was ordered internally and small pellets of cracked ice. The child recovered after careful dietetic and restorative treatment.

Intestinal Perforation.—Intestinal perforation is very rare. It is met with in about 1 per cent. of all cases. A sudden fall in the temperature with collapse, rarely vomiting, followed by tympanites, are symptoms indicating perforation.

Laparotomy When Perforation Occurs.—The skill of the surgeon will frequently save life when hæmorrhages occur. In a case of typhoid which progresses favorably during the third and fourth week, a sudden collapse should be an indication for an immediate operation. I have seen death follow a case of this kind. These cases are usually hopeless and our only chance consists in resorting to an immediate operation.

Complications.—*Aphasia* is occasionally met with. Morse reported 21 cases. *Insanity* is rarely met with as a sequel to typhoid. *Chorea* is frequently seen. I have met with a case having a severe form of choreiform movements which lasted more than a year, following the attack of typhoid.

Otitis media is frequently met with in children. It is very important to watch the ears during an attack of typhoid.

Less frequent complications are gangrenous inflammation of the mouth or genitals, pericarditis, endocarditis, peritonitis, pyæmia, abscesses, and furuncles. Abscess of the liver has been reported by Bokai. Pulmonary tuberculosis has been known to follow typhoid.

Prognosis and Course.—The prognosis is more favorable in children than in adults. Tympanites, if accompanied by vomiting, is a bad sign. When there is general depression and nervous symptoms then the prognosis is bad. Singultus is usually a bad sign. Bleeding should always be looked upon, especially if repeated, as a bad sign. The strength of the child, its assimilation of food, and the condition of the heart should be the means of arriving at the proper prognosis. Complications should always be regarded as a serious matter. The prognosis is grave if the child has passed through a typhoid and is in an exhausted condition, and unable to cope with a new complication. Baginsky states that in a series of 68 cases treated by him in the hospital, 6 died, a mortality of 8.8 per cent.

In children typhoid may terminate in two weeks. It may extend over three weeks or even four weeks. Mild cases of typhoid resemble an attack of acute gastric fever. Cases are occasionally seen in which the disease terminates abruptly within ten days. As a rule older children show the adult type of fever and the disease runs its course of three, four, or six weeks. Infantile typhoid may show severe gastric symptoms, such as vomiting, and very little diarrhœa. The course, therefore, is peculiar to infants and entirely different from that seen in the older child.

The following case was seen by me some time ago. A woman, 35 years of age, was taken ill with typhoid fever of a very severe type. She nursed her infant during the first week of her fever. The infant was then 1 year old. The physician ordered the infant weaned. About one week later the infant had fever, vomiting, and diarrhœa. An examination of the blood gave a positive Widal reaction. The infant recovered in about fifteen days. The mother died of hæmorrhages during the third week of her illness.

Treatment.—The specific nature of the disease due to the infection of a specific germ, has caused investigators to seek a typhoid antitoxin. As yet no definite progress has been made in this direction, although investigators have from time to time announced the discovery of a healing serum.[1] In the absence of a specific serum we must confine ourselves to the treatment of indications. In the beginning a good dose of calomel, 1/2 to 1 grain, repeated several times a day, is indicated.

Fever Treatment.—The best antipyretic is the cold bath and cold pack. The bath must be properly given to be effective. A large bath-tub should be procured, large enough to hold the child at full length. This should be half-filled with water at a temperature of 90° F. Cold water or, in summer, ice should be added until the temperature is gradually reduced to 70° F. This is an agreeable method, as we avoid the sudden shock so dreaded by children when suddenly immersed in cold water. The duration of the bath should be from three to five minutes.

The temperature of the child should be taken before and after the bath. The child's body should be rubbed continuously while in the bath so as to stimulate the circulation, especially so when the water is cool. If the child's pulse is feeble, administer a stimulant such as hot coffee or whisky before the bath. Watch the pulse carefully, and if the slightest sign of weakness is noted, remove the child immediately from the bath and place in bed with hot-water bottles to its feet. The bath should be repeated every three or four hours or oftener, if the temperature requires it. If the temperature is not modified lower the temperature of the bath.

Antipyretic drugs, such as napthaline, benzoate of soda, quinine, antipyrin, antifebrin, phenacetin, and lactophenin, are useless in combating fever when compared to cold baths and cold packs. All antipyretic drugs of the coal-tar series are such cardiac depressants that they should never be prescribed without combining them with camphor or musk. Of all antipyretic drugs I prefer phenacetin. One of the best antipyretic measures is the injection of several pints of cold saline solution through a catheter into the colon. Too much hydrostatic pressure should not be used. The irrigator should be held about one foot over the child's body; the temperature of the water should be between 60° and 70° F. Flushing the colon with cool saline solution may be repeated every three or four hours if a good effect is apparent. When great exhaustion and a weak pulse exist, then 1/2 teaspoonful or a teaspoonful of alcohol may be added to the irrigation. The main point to remember in the treatment is to support the child so that the strength will be maintained and the heart's action not impaired. With this object in view nothing is better than restoring vitality by the aid of concentrated food. When there is great exhaustion the administration of a normal salt solution per rectum, or its use by hypodermoclysis,[2] should be remembered. One or two pints of saline solution administered per rectum, with the hips elevated, is frequently the means of stimulating diuresis, thus eliminating the poisons of the toxins through the kidneys. Great care is required in giving the saline in the form of hypodermoclysis. The strictest asepsis should be maintained. A large aspirating needle attached to a fountain syringe (Fig. 208) is well adapted in an emergency. These saline injections may be repeated every six or twelve hours if required.

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[1] Einhorn, of New York, has reported beneficial results from the use of antityphoid serum.

[2] This is illustrated in detail in the chapter on "Scarlet Fever Treatment."

Hygienic Measures.—Owing to the infectious nature of the discharges passing from a typhoid patient, the prime requisite is the thorough disinfection of all stools and urine. If there is cough or sputum, the same must also be thoroughly disinfected. In fact all discharges should be received in a vessel containing a strong solution of javelle water (chlorinated lime) or a 5 per cent. carbolic solution. A strong solution of copperas should be thrown into the toilet from time to time while a typhoid patient is in the house. All bed linen, handkerchiefs, and dishes coming in contact with the patient should be soaked in a bichloride solution for at least one-half hour before being washed. *Sunlight* is of the greatest importance in a room having a typhoid patient. We can do more disinfection with sunlight and fresh air than we can with medication.

The Food.—All food must be liquid: no solid food should be allowed. In the beginning whey, strained soups, and broths should be ordered; later strained gruels, cocoa, acorn cocoa, and chocolate may be given at intervals of two or three hours. In some cases albumin water, made by beating the raw whites of two eggs with sugar and water, is useful. I frequently give the whites of six eggs per day. Milk, buttermilk, kumyss, whey, or junket may be given, alternating with soups and broths. When stimulation is required the yolk of egg can be combined with sherry or Tokay wine. When drugs are given it is best to combine them with soups or broths. When severe dyspeptic symptoms exist, predigested milk, peptonized with the aid of pancreatin and soda, must not be forgotten. When milk idiosyncrasies exist, then the yolk of a raw egg added to barley water, rice water, or almond milk (made by blanching almonds with hot water) can be substituted for milk. When thirst exists, unfermented grape juice or water acidulated with dilute phosphoric acid or dilute hydrochloric acid is very grateful. Ten drops of either dilute acid can be added to a tumblerful of sweetened water, and this given whenever the child is thirsty. These acids have a very good effect on febrile affections, and are especially indicated when diarrhœa exists.

Feeding in Convalescence.—The great danger of hæmorrhage should always be borne in mind: hence it is advisable to abstain from giving solid food for several weeks after convalescence is thoroughly established. Soups thickened with sago, farina or barley, and pea and lentil soups can be given. The yolk of a raw egg can be added to the soup. Milk may be thickened with zwieback. The main diet should be milk and cocoa or chocolate.

Somatose may be added to milk or soup. Plasmon is also beneficial. Bovinine, liquid peptonoids, panopeptone, eucasin, or tropon, in teaspoonful doses added to milk, are very valuable during the convalescent period. Valentine's meat juice given in milk or soup is nutritious, or Mosquera's liquid beef (made by Parke, Davis & Co.) can be added to each soup or milk-feeding.

Drug Treatment.—If cerebral symptoms exist, then an ice-bag should be applied to the head. When there is severe restlessness and insomnia, with twitchings of the muscles, then injections of 3 to 5 grains of chloral hydrate should be tried per rectum. These injections are best given in starch water. Five-grain doses of sulphonal or trional, repeated in two hours if necessary, is sometimes very effectual. If there is no effect, then $^1/_{24}$ grain of morphine may be administered hypodermically for a child 2 years old.

If the child is 1 year old, then $^1/_{48}$ grain may be given, and repeated in several hours, if necessary. The greatest care must be maintained if hæmorrhage exists.

Bismuth is a very valuable drug; the subnitrate in 5 to 10-grain doses, and the beta-naphthol, in 5 to 10-grain doses, may be repeated every few hours as an antifermentative.

Tannalbin or tannigen, in doses of 5 to 15 grains, can also be given every two hours. If the hæmorrhage is very severe, then an injection containing 30 drops of Monsell's solution added to a quart of cool water, or a teaspoonful of alum, may be added to a pint of water. These injections can be repeated every three or four hours until the hæmorrhage ceases. Ice-bags should be kept continuously on the abdomen at the slightest sign of hæmorrhage.

Guaiacol carbonate, in 5 to 10-grain doses, repeated every three or four hours, is a very good antipyretic. Creosote carbonate, 1 drop for each year; for a child 1 year old, 1 drop; for a child 5 years old, 5 drops, three times a day, is one of the best intestinal antiseptics.

When severe tenesmus, associated with flatulence and very loose stools, exists, then the best remedy will be 1 or 2-drop doses of turpentine, combined with several drops of paregoric. The oleoresin of turpentine in 1 or 2-grain doses, can be combined with $^1/_{10}$ grain of extract of opium for a child, 5 years old, in the form of a suppository. This can be repeated several times a day if the symptoms are not improving.

CHAPTER XIV.

ERYSIPELAS.

THIS is an acute infectious and contagious disease. It is characterized by an inflammatory condition of the skin, the subcutaneous tissue, the lymph spaces, and the lymph vessels.

Etiology and Bacteriology.—We are indebted to Fehleisen for a study of the bacteriology of this disease. Fehleisen found the streptococcus present, so that it is positively identified as the cause of the same. The disease may also originate from a staphylococcus aureus.

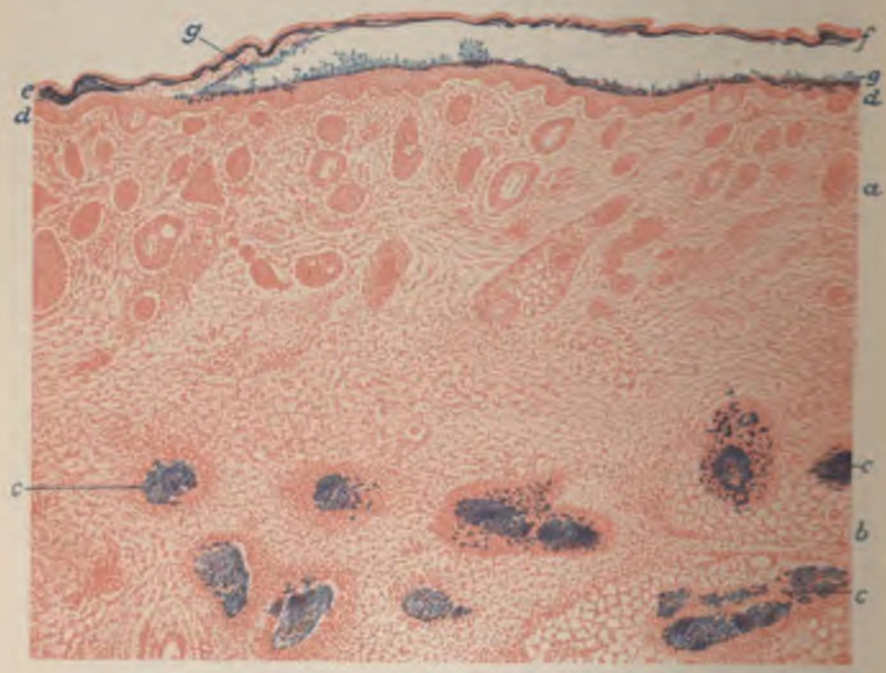

Fig. 221.—Ectogenous Streptococcus Infection. Eczema and erysipelas of the scalp in a child 1 month old. (Bacteria carmine stain); (*a*) cutis; (*b*) subcutis; (*c*) lymph vessels filled with streptococci, surrounded by an inflammatory area; (*d*) epithelial covering; (*e*, *f*) elevated horny layer; (*g*) streptococci. X 50. (Ziegler.)

The invasion of the micro-organism takes place through an abrasion of the skin caused by scratching with a dirty finger-nail. It is very rarely epidemic, but can spread easily from patient to patient. A case of erysipelas is a source of great danger in a hospital ward.

Pathology.—There is an infiltration of the tissues and they are usually swollen from an accumulation of serum. Under the microscope we can find pus cells in the serum. When this condition is noted abscesses will be found. In other cases gangrene will be present. There is nothing characteristic found in the lungs, heart, kidneys, spleen, or liver which would be distinctly pathognomonic. The usual conditions found in sepsis are seen here.

Pneumonia is sometimes met with as a complication.

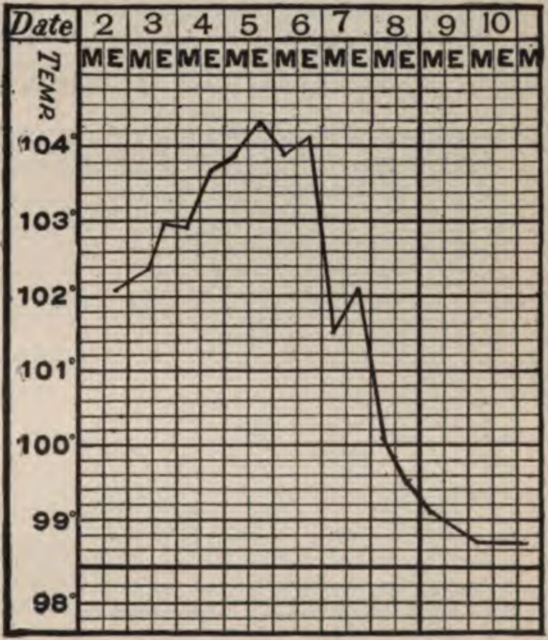

Fig. 222.—Fever Curve in Facial Erysipelas. (Original.)

Symptoms. — The usual type of erysipelas met with in children is known as erysipelas migrans. This is known as the wandering type because it spreads rapidly from diseased to healthy parts. The temperature in the beginning varies from 102° to 103° F., and may rise to 104° or 105° F. Septic cases usually show a much lower temperature. I have seen cases of a decided septic nature in which the temperature was 99° F. for several days. The pulse-rate varies between 120 and 150. The flush is of a deep red color and usually very shining. The following case seen by me in consultation with Dr. B. Brodski will illustrate severe erysipelas:—

Child M., 6 years old, suffered with severe coryza from acute rhinitis. There was an artificial eczema due to excoriation around the nose. The intense itching caused the child to scratch the parts and when the attending physician saw this case he found a well-defined erysipelas. Local remedies, such as lead and opium wash, and warm bichloride were used. The erysipelas spread over the face and at this time involved the eyelids so that the eyes were tightly closed. The forehead, nose, and cheeks were involved. This was the fifth day of the disease.

Ten cubic centimeters of antistreptococcus serum were injected. The temperature at the time of injection was 103° F.; the following day the skin seemed to desquamate and lose its fiery red appearance. I also advised thorough inunctions of unguentum Credé, three times a day. With the aid of restoratives and good nutrition the case recovered in about six days after the above treatment was commenced. No complication ensued, although at one time meningitis was suspected.

Another case equally instructive was seen by me in consultation with Dr. Henry M. Groehl:—

Baby K., 1 year, was seen on her fifth day of illness by Dr. Groehl, who found a well-marked case of erysipelas involving both the lower extremities. The temperature was 104 $^{2}/_{5}$° F. The child was very restless. The flush spread to the back and over the abdomen. He ordered locally lead and opium wash to cool the surface, and internally he gave calomel and phenacetin with sparteine.

On the sixth day the child was much improved. Temperature fell to 99° F., pulse was good. On the seventh day there was a marked change for the worse. The temperature still remained at 99° F., the pulse was rapid and feeble; there was continuous vomiting. The inflammation suddenly spread from the abdomen to the chest, almost covering the child. The appearance was decidedly septic. The child vomited long after all drinks by the mouth had been stopped. In fact, long after rectal feeding had been commenced the vomiting persisted.

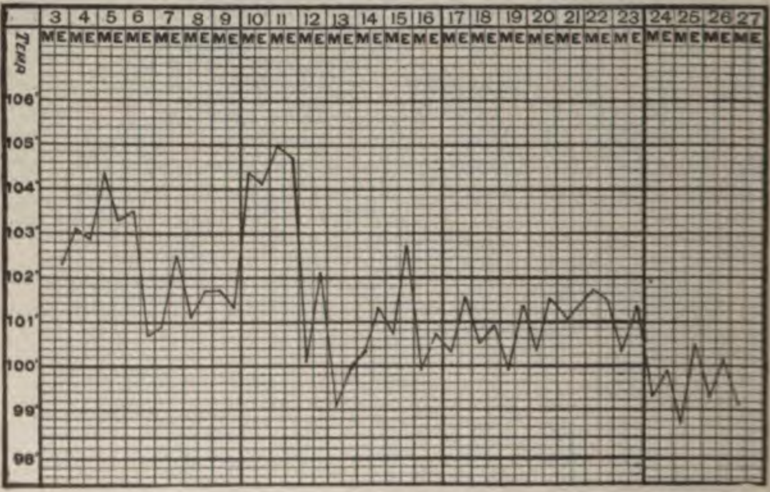

Fig. 223—Fever Curve in Phlegmonous Erysipelas. (Original.)

On the eighth day of the illness I saw the case, and after going over the history and treatment, recommended injections of 10 cubic centimeters of antistreptococcus serum. This was injected in the usual aseptic manner, just as we inject antitoxin. On the evening of the same day of the injection there was no reaction. The child continued the same.

The following day, about three hours before the exitus lethalis, the body was covered with ecchymotic spots. The various parts of the body were covered with discolorations, some of them resembled the colors of the rainbow.

Complications.—The œdema usually seen on the skin is a very fatal complication in erysipelas affecting the air passages. In such cases œdema of the glottis will result fatally.

Prognosis.—This depends upon the time when the case is first seen and chiefly upon the condition of the child at the time of the infection. If the child is well nourished and has been breast-fed, the prognosis is good.

Treatment.—A dose of rhubarb and soda or 5 to 10 grains of phosphate of soda should be given. The destructive tendency of the pathogenic bacteria on the blood should be remembered; hence large quantities of normal saline solution should be given, by injection, into the colon. The strictest hygienic measures must be used. The internal administration of active diuretics, such as spirits nitr. dulc., are indicated. The strength of the child should be supported with proper food, so that it can throw off the poison. The most effectual treatment is the local treatment, especially if fever exists.

Local Treatment.—Pure alcohol in which bichloride of mercury is dissolved, should be applied continuously by saturating absorbent cotton and laying the same over the erysipelatous flush:—

℞ Alcohol	2000 parts
Bichloride of mercury	1 part

In some cases lead and opium wash is very cooling and will remove the heat from the affected parts.

Oil silk or rubber tissue should cover the wet application to prevent evaporation. The inunction of a 10 per cent. ichthyol ointment has been tried by me with some success. I regard the use of Credé ointment as a very efficacious remedy.

Collargolum (Soluble Metallic Silver).—In septic scarlet fever and in severe types of erysipelas in which a profound toxæmia exists, rectal injections of collargolum are useful. It should be administered in the following manner:—

℞ Collargolum	$2^{1}/_{4}$ to $4^{1}/_{2}$ grains
Aq. dest.	$2^{1}/_{2}$ ounces

The above to be used for a colon injection after the rectum and colon have been cleaned of fæces.

Intravenous injections should consist of:—

℞ Sol. collargolum	5 per cent.

Sig.: Inject 10 to 30 minims, with a hypodermic syringe, using one of the veins in the back of the hand. Study its effect and if there is no improvement the same may be repeated two or three times a day. A careless injection may cause death—if air is forced into a vein.

Serum Treatment.—Since the streptococcus has been found to be the etiological factor in erysipelas, the most plausible treatment has been the anti-streptococcus serum. The clinical cases described in this chapter show very good results from the serum treatment. I have seen specific results after using 10 to 20 cubic centimeters of this serum, and strongly advise the use of the same in this disease.[1]

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[1] Read also clinical report of case of erysipelas complicating varicella in chapter on Varicella, page 678.

CHAPTER XV.

MALARIAL FEVER (INTERMITTENT FEVER—PALUDAL FEVER—AGUE).

THIS is a specific infectious disease due to the invasion of a distinct germ belonging to the class of protozoa. It is known as the plasmodium malariæ. "The disease is contracted by the inoculation of the human subject by the infected mosquito. The plasmodium malariæ passes through one cycle of its development in the body of a variety of the mosquito known as the anopheles cleviger."

We find this disease in Southern Russia and in Italy; in our own Southern States as well. In the North of Europe and the North of America it is rarely found. The disease is usually seen in swampy regions and where bad drainage exists. It is also seen in the tropics. The influence of the weather is interesting. While in summer, spring, and fall cases occur frequently, in extremely cold weather they are very rare.

Bacteriology and Etiology.—Laveran, in 1880, discovered the specific germ which causes this disease in the blood of infected individuals. In America, Councilman, Abbott, Osler, and many others have confirmed Laveran's observations. There are several types of fever.

First.—The middle forms: *(a)* tertian, double tertian (quotidian); *(b)* quartan fever and its combinations.

Second.—The more severe, often more or less irregular fevers which occur in America and in Italy, most commonly at the end of the summer and fall, called the æstivo-autumnal fever of the Italians. The tropical malaria of the Germans. This type of fever includes the so-called remittent malarial fevers as well as most of the cases of pernicious malaria and other malarial cachexiæ.

Tertian Fever.—Golgi's description and differentiation of the microorganism of the tertian and quartan type of malaria have remained practically unassailed. "If we examine the blood from a case of tertian fever just after the paroxysm, we find in certain of the red blood-corpuscles small, round, colorless bodies which appear to have a slight depression in the center, and when stained in dry specimens show a paler central area with a darker periphery. These bodies examined in the fresh specimen show active amœboid movements. A few hours later the organism will be found to have increased somewhat in size, and to contain a few, fine, brownish pigment granules which dance actively under the eye, the motion probably being due to undulatory movements in the protoplasm. On the day between the paroxysms the bodies will be found to have about half-filled the red corpuscles. They are still actively amœboid, and the number of pigment granules has considerably increased. The red corpuscle at this stage will be seen to be a trifle larger than its unaffected neighbors, and to be considerably decolorized. On the day of the paroxysm the organism has entirely filled and almost destroyed the red blood-corpuscle, which is represented only by a faint pale rim about the full-grown parasite, if, indeed, it has not entirely disappeared. The pigment granules may show at this stage a very active motion, but the amœboid movements of the organism as a whole are but little marked. At the time of the paroxysm an interesting change takes place; the pigment gathers together in a more or less solid clump, usually in the center of the organism, while the rest of the protoplasm looks somewhat granular and shows a suggestion of lines radiating outward from the center. This appearance gradually changes, the lines becoming more distinct, until finally we see the central clump of pigment surrounded by from fifteen to twenty small ovoid or round glistening segments, each one having a central more refractive spot, and resembling strongly the hyaline bodies which we see immediately following the chill. This segmentation of the organism is always coincident with the paroxysm, and the presence of the blood of a segmenting body is a sure indication that the paroxysm is present, or is about to occur. Immediately following the paroxysm fresh hyaline bodies appear in the red corpuscles. Though the invasion of the corpuscles by these fresh segments has never been actually observed, the evidence that this occurs is so strong that we can safely accept it as a fact. Besides these forms we see not infrequently small or large extra cellular pigmented bodies; that is, organisms resembling exactly those within the red blood-corpuscles, excepting that they are free in the blood current.

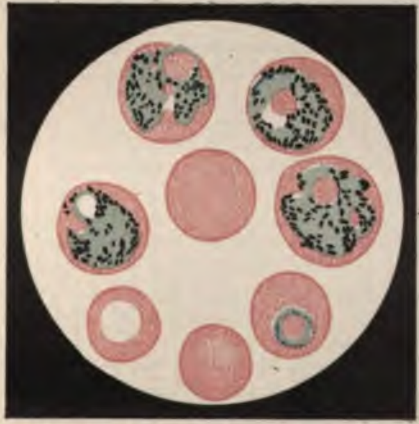

Fig. 224.—Malaria Plasmodia; Tertian Type. Plehn-Chenzinsky's Stain. X 1000.

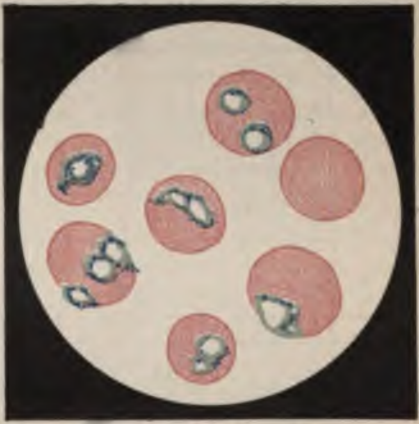

Fig. 225.—Malaria Plasmodia; Tropical Form. Romanowsky-Nocht Stain. X 1000.

These may be seen at times to break up into several smaller bodies, while at other times they may show a long, tail-like, non-motile process containing sometimes a few pigment granules. They are probably organisms which have escaped from the red corpuscles, or full-grown bodies which have broken up; they are considered to be degenerative forms. At times also we find the so-called flagellate bodies. Their development from the pigmented organism may indeed be observed, the pigment of the full-grown body becoming very actively motile, then collecting in the center of the organism, while several long, thread-like flagella burst out of the body and move actively about among the surrounding corpuscles. Sometimes we may see one of these flagella which has broken away from the organism and is moving rapidly through the field. This is also thought by the Italians to be a degenerative process. The characteristics of this form of organism, which is observed in tertian fever alone, are so marked that with a little study of the parasite one can make a definite diagnosis of the type of fever from an examination of the blood alone.

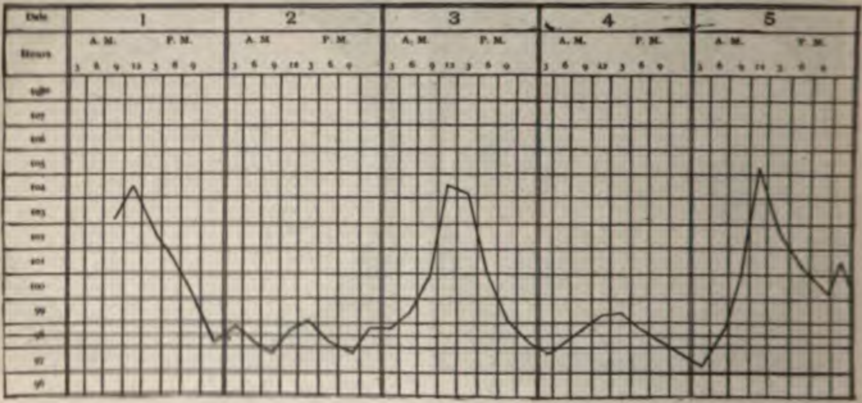

Fig. 226.—Tertian Fever (Intermittent Fever). Typical malarial temperature, usually seen in the spring and early summer. Onset with vomiting, diarrhœa and chills, accompanied by a well-marked rigor, and coldness of the extremities. (Original.)

The Parasite of Quartan Fever.—"Quartan fever is not at all common in this country, but in the few cases which the writer has observed the organisms differ distinctly from the tertian parasite, and show accurately the characteristics described by Golgi. Here the first stage of the organism is similar to that observed in tertian fever, excepting that the amœboid movements are not so active. As the body develops, the rods and clumps of pigments are larger and darker than those in tertian fever, while the amœboid movements of the organism are relatively slight. The full-grown forms are materially smaller than in tertian fever, while the red blood-corpuscles, instead of being expanded and decolorized, appear at times shrunken about the body, and of a somewhat deeper old-brass color (messingfarbe). In segmentation the organism divides into from six to ten different parts instead of twenty to thirty, as in the tertian form.

The Organisms of the Æstivo-autumnal Fevers.—"The organisms associated with the æstivo-autumnal fevers have been carefully studied, but much remains to be done, particularly in this country.

"There is some difference of opinion as to whether there are not two types of organism associated with these fevers. Some Italian observers divide them into the quotidian and the malignant tertian organisms. The differences made out by the Italians are, however, very slight, and have not been observed in this country. In the first place we see just after the paroxysm small hyaline bodies which may or may not be actively amœboid; these can sometimes be distinguished in that they are generally somewhat smaller and have oftentimes a characteristic ring-like appearance. In the early stages—during the first week, for instance—of an attack of this form, we may see only the hyaline, unpigmented forms; but commonly, if we observe carefully, we may see some time after the exacerbation of temperature, shortly before the beginning of another, bodies which are a trifle larger than these smallest hyaline forms and which contain one or two very minute pigment granules lying near the periphery. Just before or during the paroxysm we may see bodies with a small central clump of motile or non-motile pigment granules lying usually in cells which are more or less shrunken and crumpled, and of a deeper color than the normal corpuscles (messingfarbe). These bodies are generally not half as large as the red corpuscles. After the first week or ten days of the disease, or after treatment has been begun, we see, however, certain very characteristic and easily recognizable forms which are only seen with this type of fever. These are, first, round or ovoid bodies about the size of a red corpuscle, a little smaller or a little larger, with clear, rather highly refractive, waxy-looking proto-

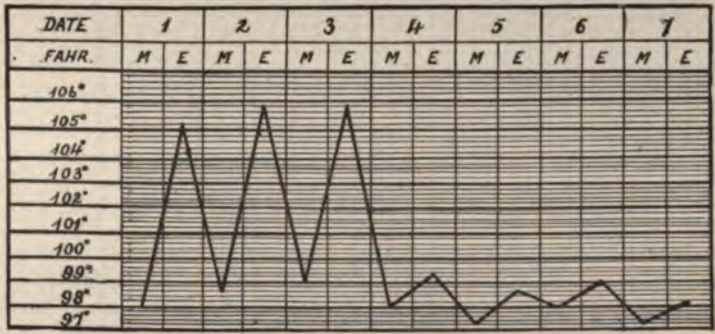

Fig. 227.—Quartan Fever (Double Tertian). Onset with vomiting and convulsions. Convulsions usually accompany each paroxysm. Restlessness associated with cyanosis and coldness of extremities. These cases are usually seen in the late autumn. (Original.)

plasm, and coarse dark pigment granules, which are usually collected in a ring or a mass in the center of the organism. The granules are usually very slightly motile. At one side of the body we often see a small bib-like attachment which may show a slightly yellowish color. On examination this proves to be the remains of the red blood-corpuscles in which the organism has developed. In association with these are seen crescentic bodies, the protoplasm of which shows the same characteristics as that in the forms above described, while the pigment is collected in the middle in a similar ring or bunch, and is but slightly motile. On the concave side of these crescents one may also often see a bib-like attachment, just as in the ovoid forms. At times during the examination of the fresh specimen we may see the change from an ovoid body into a crescent take place, The development of these forms from the hyaline bodies can be followed out on careful observation. They are thought by some to be a resting stage of the organism. Segmenting bodies are almost never seen in the circulating blood of this form of malarial fever, though the presence of the round intracellular bodies with central pigment is a sure sign that segmentation is going on elsewhere. It has been found by the Italians that after the accumulation of a few pigment granules the organisms seek the internal organs, where segmentation takes place. The bodies are still small and contained within the red corpuscles. The pigment gathers in the center, as in the other types of segmentation, while the segments are very small and rarely more than twelve in number. During the paroxysm we may see large numbers of leucocytes containing pigment granules and clumps which are probably the remains of segmenting organisms. Flagellate bodies may be observed here as in the tertian and quartan fevers, but only when ovoid and crescentic pigmented bodies are present. They may be seen to develop from the round

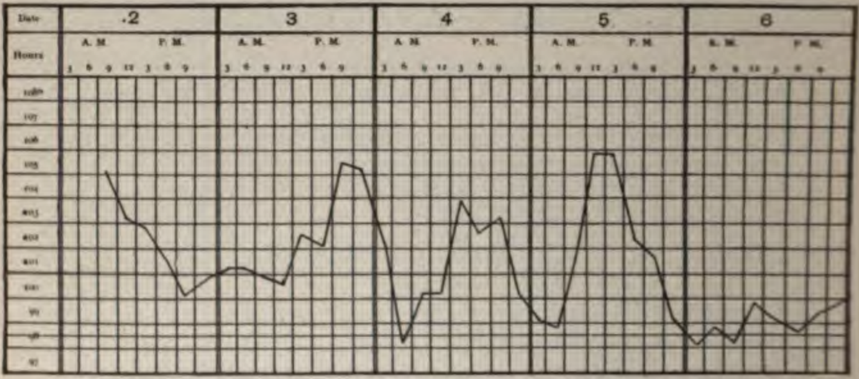

Fig. 228.—Æstivo-autumnal Fever (mild type). Ushered in with vomiting, restlessness and flushing. The spleen is enlarged. Either delirium or drowsiness and somnolence exists. (Original.)

bodies with central pigment. Careful studies concerning the morphological characteristics of the malarial parasite have shown that it belongs to the class of protozoa, and is possessed of a nucleus containing one or more nucleoli. At the time of sporullation this nucleus divides—according to some—directly, according to others by karyokinesis."

Pathology.—In fatal malaria the following changes are found:—

The spleen is enlarged; the capsule tense. Death has been reported from rupture of the spleen (Thayer). The pulp of the spleen contains large numbers of red blood-corpuscles in which the characteristic parasite is found. "The capillaries are usually filled with the plasmodia, while the splenic veins show relatively few, though they always contain large cells enclosing pigment or the remains of red corpuscles."

The Liver.—Small areas of necrosis are described by Guarnieri: "Numerous liver cells are found containing clumps of hæmatin and altered red corpuscles, a condition similar to that found in pernicious anæmia. Bignami believes that this may explain the polycholia found in cases that died of pernicious malaria."

Examination of the Blood.—A small drop of blood should be taken from the ear or from a finger tip. The usual aseptic precautions, such as carefully washing the finger with soap and water, followed by a washing with alcohol or ether, should be strictly carried out. Fresh blood must be examined soon after it has been withdrawn—no later than three or four hours. A film of blood can be preserved if the air is excluded by smearing vaseline around the edges of the cover glass. The amœboid movements of the protozoa can be studied in this fresh blood. Blood for examination should be drawn about one hour before the expected paroxysm. The organisms are much smaller after a paroxysm.

"The tertian parasite completes its life in about forty-eight hours, or less, if there is any variation from this time. In the first twelve hours of their life the parasites appear as small, clear specks (hyaline bodies) in the red corpuscles, and if any pigment is to be seen it is as very small granules. If stained they appear pale blue. They are actively amœboid, and remain so for about an hour after withdrawal. In the next twelve hours the parasites have grown to about one-third the size of the corpuscle, are still amœboid, show fine granules, and the corpuscle has become paler. In the next twelve hours the parasites have taken up about two-thirds of the cell, have become less amœboid; the granules larger and moving. The parasites are now more irregular in shape, and the corpuscles larger and paler, the pigment granules standing out more markedly. In the next twelve hours all motion ceases, the corpuscles become shells, the centers of which are occupied by the parasites, and spore formation and segmentation begin. The organisms break up into fifteen or twenty round spores, at first contained inside the cell-wall of the red corpuscles, and then set free into the blood. It is at this time that the clinical paroxysm occurs. All hyaline bodies do not develop to the stage of spore formation, nor do all these spores—really the young hyaline bodies—which have been set free into the blood serum re-enter the red corpuscles, but the blood plasma itself destroys many of them.

"Should we have under observation clinically a quotidian form of malaria, the red corpuscles would show the tertian parasite in but two stages of development, one group being approximately twenty-four hours older than the other; of course, depending upon the hour at which the paroxysms occur. This is due to a double infection. It must not be forgotten, however, that we may have a triple quartan infection that produces daily paroxysms.

"The quartan parasite grows in seventy-two hours. In the first twelve hours it is a very small, unpigmented, slightly amœboid, hyaline body, becoming in twelve hours more about the size of one-sixth to one-fifth that of the corpuscle, having taken on a few pigmented granules placed peripherally. In forty-eight hours it is one-half to two-thirds the size of the red corpuscle, round, as a rule, and possessing no amœboid movement. In sixty hours from the paroxysm, it occupies nearly all of the corpuscle, which is neither enlarged nor paler than normal. In six hours more the pigment granules approach the center and are arranged like the spokes of a wheel, the first sign of segmentation. About three hours before the attack, segmentation has produced from six to ten oval or pear-shaped bodies or spores containing pigment in their centers. In multiple infections of this type we, of course, find the organisms in the blood in different stages of development. Flagellated bodies develop after the blood is removed from the body, and consist of a central cell with arms thrown out. These arms are freely movable. In examining a fresh specimen, we may see such a body keeping up a constant ciliary motion and causing a disturbance in the arrangement of the red cells in its immediate neighborhood. The flagellated body does not often appear in either of the foregoing types of the infection, but is more common in the æstivo-autumnal variety. The second group of parasites belongs to the class of malignant or æstivo-autumnal figures, and are divided into, *first,* the pigmented quotidian parasite; *second,* the unpigmented quotidian parasite; and *third,* the malignant tertian.

"The pigmented quotidian parasite completes its cycle in twenty-four hours. When seen in the blood-corpuscle, it appears as a small actively amœboid, hyaline body, rapidly becoming pigmented and quiet, the pigment lodging in the periphery of the organism, after which it breaks up into spores. It has been pointed out that segmentation of this type does not take place in the peripheral blood, but occurs in the spleen and bone marrow. The pigmented organism occupies one-third of the corpuscle which is shrunken, if changed at all. After the infection has lasted for several days crescents appear.

TABLE NO. 94.

		Develops in	Movements.	Pigmentation.	Maximum Size.	Forms of Spore Formation.	Number of Spores.	Crescent Bodies.	Alterations in the Infested Blood-corpuscles.
Simple Intermittent Fever	Quartan parasite	Seventy-two hours	Small movements in immature forms	Coarse granules, little or no movement	Size of red blood-corpuscles	Daisy form, single spores, round, with distinct nucleolus	6 to 12	None	Red blood-corpuscles are little discolored and do not alter their size.
	Ordinary tertian parasite	Forty-eight hours or less in anticipating cases	Active amœboid movements in immature and also in middle-aged forms	Fine granules in immature forms, often in the larger, actively swarming	Size of red blood-corpuscles, sometimes larger	Sunflower or grape-like, single spores, small round nucleolus; rarely seen	15 to 20, often less	None	Red corpuscles are often hypertrophied, and lose their color quickly and completely.
Malignant or Æstivo-Autumnal Fever	Pigmented quotidian parasite	Twenty-four hours	The unpigmented, immature forms actively amœboid, less active when the pigment accumulates	Very fine, later coalesced in one or two lumps. Does not swarm	One-fourth to one-third the size of red blood-corpuscles	Irregularly formed heaps	6 to 8, often more	Present	Red blood-corpuscles often shrink, and are thin, either take stain copper-colored or may be completely decolorized.
	Unpigmented quotidian parasite	Twenty-four hours or less	Very active, amœboid movements	None	One-fifth to one-fourth the size of red blood-corpuscles	Star-shaped or in irregular heaps	6 to 8	Present	Red corpuscles shrink frequently and are darker stained.
	Malignant tertian parasite	Forty-eight hours	Active movement remains present in pigmented bodies	Moderately fine; often shows the oscillatory movement	One-half to two-thirds the size of red blood-corpuscles	Irregular heaps	10 to 12, rarely 15 or 16	Present	Red blood-corpuscles shrink frequently and are darkly stained or may be perfectly colorless.

"*Crescents are always an evidence of æstivo-autumnal fever*, and never occur in the quartan or tertian type. They are from eight to ten micromillimeters in length and from two to three micromillimeters in breadth, are half-moon shaped when typical, but vary greatly, oftentimes appearing almost straight. They contain pigment sometimes scattered, but oftener found clumped in the center, and usually without motion. With a good light and an accurate adjustment the shell of the red blood-corpuscle can be seen extending from the poles of the crescent, showing that this parasite is distinctly an intracellular formation. Crescents are distinctly an evidence that the infection has lasted a number of days,—five or six—and they will not be found in any specimen before that time. The unpigmented quotidian parasite shows not many variations from the foregoing type, except that it is free from the pigment, though the crescents formed from this variety may show pigmentation. The malignant tertian parasite is pigmented and, in fact, much like the pigmented quotidian. It grows to segmentation once in forty-eight hours, and is amœboid in the advanced stage; the pigment is active and the entire organism is larger. Probably no better idea can be given concisely of the different characteristics of these parasites than by reproducing the table of Mannaberg." (See p. 713).

Symptoms.—In very young children there may be convulsions, restlessness, cold extremities, and yawning. The pulse is full and rapid. The temperature may reach as high as 105° F., or even higher. After this febrile stage the body is covered with a profuse perspiration, ending in sleep from exhaustion. Diarrhœa is ocasionally met with in this condition, and is probably the result of secondary infection. Bronchitis is occasionally seen. The paroxysm of fever occurs when the protozoa matures and begins to divide. This process repeats itself about every twenty-four hours in the tertian type of intermittent fever most frequently seen in this country. If children are carefully observed, then the onset of a paroxysm is frequently seen by a severe cyanosis affecting the nails. This would correspond to the chill seen in the older children. Slight albuminuria or hæmaturia frequently accompanies malaria. There is no disease that can be mistaken for the tertian type of malaria when it is remembered that there is a sick day with fever, etc., and an alternating apparently healthy day.

An enlarged spleen is usually present.

Diagnosis.—This can be most positively made by an examination of the blood. So many symptoms present in malaria, such as lassitude, pains in the bones, headache and fever, simulate other diseases, that only the positive finding of Laveran's protozoa in the blood will complete the diagnosis.

Differential Diagnosis.—If there is a doubt as to the differential diagnosis between tuberculosis and malaria, the specific effect of a few doses of quinine will easily show the presence or absence of malaria. The blood test is, however, conclusive.

A boy, 6 years old, was brought to me at the children's service of the German Poliklinik with a history of headache, fever, and pain in the bones. The boy appeared rather icteric. His mother said that he had lost weight during the last two weeks. He perspired freely, had a good day and a bad day. The fever appeared in the afternoon. The examination showed a well-nourished boy, lungs normal, a slight hæmic murmur at the apex of the heart which was also heard in the vessels at the neck. The spleen was palpable and slightly enlarged. The appetite was poor, the bowels moved sluggishly. The child was restless at night. The examination of the blood showed the presence of the ordinary tertian parasite. Quinine in 3-grain doses was given every four hours, and 6 grains were given three hours before the expected attack, which in this condition was between 1 and 2 o'clock in the afternoon. Fifteen drops of cascara sagrada were administered before breakfast of each day. The treatment was continued for ten days. The boy then complained of buzzing in the ears, evidently due to cinchonism. Quinine was given every second day and Fowler's solution in 3-drop doses was administered on alternate days. Strengthening food was given and the child made a complete recovery. Quinine was given once every three days after the first month. The child took an ocean voyage and was perfectly well in two months. Iron was then given for several months as a tonic and the treatment discontinued.

Prognosis.—This is usually good. If malaria is neglected severe anæmia follows, and if pernicious malaria results it may end in death. In this country the specific effect of quinine and the change of climate usually gives successful results.

Treatment.—A patient suffering with malaria should, if possible, be removed to a different climate. A change from the city to the country, or *vice versâ,* is very beneficial. Next in importance to change of air is the specific effect of quinine. Five grains of quinine (0.3) can be given to a child 3 years old. The hydrochlorate of quinine is the most effective. Owing to its disagreeable taste it can be given in tablet form, after which a mouthful of coffee or chocolate can be given. When quinine is refused by mouth, then a 10-grain dose in the form of a suppository can be given three times a day, per rectum. *The best time for administering quinine is about three hours before the expected attack.* The bisulphate of quinine is a soluble and convenient form to use. It is very important to keep the bowels open and the kidneys active. Fifteen to 30 drops of fluid extract of cascara sagrada can be given in a palatable menstruum every morning, so that the action of the bowel is assisted. In true malaria, I have found especial benefit in administering whisky well diluted with water, or given in milk. Apart from its nutritive properties, it certainly has decided antiseptic properties. If malaria persists in spite of continued treatment, then arsenious acid in doses of $^1/_{100}$ or $^1/_{150}$ grain, can be administered three times a day. Fowler's solution, in doses of 1 to 5 drops, should not be forgotten. Jacobi recommends ergot in doses of 20 to 50 drops every day for weeks. When it is not well borne he combines it with quinine or arsenic. I have never been able to see the slightest benefit from the use of ergot, although I have tried it in many cases. I believe Jacobi's results were good when he combined the ergot with the quinine *because the quinine* was given.

CHAPTER XVI.

SYPHILIS.

This is a specific disease most probably caused by the invasion of a micro-organism. The disease in infancy is the same as that found in adults. There are two forms of the disease:—

1. Inherited syphilis.

2. Acquired syphilis.

Etiology.—The most frequent modes of infection are:—

By nursing from the breast of a syphilitic wet-nurse.

By eating from the dishes of syphilitic patients.

By infected surgical instruments; for example, when an infant is vaccinated, or during the operation of circumcision.

The Transmission of Syphilis in Utero.—An infant in utero may be infected directly through the circulation in the placenta. If the mother becomes infected during the ninth month of her pregnancy, the same will not infect her child nor modify its development. A healthy infant in utero may be infected by passing through a syphilitic genital tract of its mother during labor.

When the ovum is infected with syphilis, which frequently happens at the time of conception, it may terminate in the death of the fœtus, resulting in an abortion or in the birth of a still-born child. If the child lives it may suffer with cachexia, and a few weeks later present the characteristic skin-lesions. The father can infect the mother for three or, at the most, five years after his chancre. The father may infect the fœtus as late as twenty years after his chancre, when for years he has presented no signs of syphilis. The mother may have a series of syphilitic pregnancies resulting in miscarriages or in syphilitic infants, without at any time herself presenting any syphilitic manifestations. In the same couple the severity of the infection transmitted to the fœtus tends to decrease with succeeding pregnancies. Thus it is the rule for the mother to have at first several abortions, then a child born dead, and finally a living child showing the evidences of inherited syphilis. Children born later usually suffer less severely, but this "law of decreases" (Diday) is not without numerous exceptions; sometimes the third or fourth child suffers more than the second. In other families children of one sex suffer more than those of the opposite sex. In twin pregnancies one may be affected while the other apparently escapes. The apparent escape of the mother of syphilitic infants by a syphilitic father has been accounted for on the supposition that she undergoes a mitigated infection derived from the fœtus. Coutts[1] has pointed out the theory that she absorbs from the fœtus a syphilitic antitoxin; this would account not only for her apparent immunity, but also for the gradual decrease in the severity of the disease in later pregnancies. If the mother be infected but not the father, death of the fœtus is the most likely result. If the child is born alive it will probably suffer from inherited syphilis. If both parents have suffered from manifest syphilis, the chance of abortion or still-birth is greater.

Colles's Law.—In 1837 Colles wrote that "A new-born child affected with inherited syphilis, even though it may have the specific lesions in the mouth, never causes infection of the breast which it sucks if it be the mother who nurses it, although continuing capable of infecting a strange nurse." The substantial truth of this dictum has not been seriously questioned, though various explanations have been offered.

Is Inherited Syphilis Contagious?—The following interesting conclusions are based upon Robert W. Parker's twenty years' experience in the East London Children's Hospital:—

1. The children of syphilitic parents very frequently show manifestations of a disease which is almost universally called "inherited syphilis."

2. In a large proportion of the cases this inherited disease is not syphilis at all, in that the disease is non-contagious, and would be better named "inherited from syphilis."

3. This inherited syphilis is true syphilis only if it conform to the ordinary tests which pertain to contact syphilis, and prove to be infectious and contagious.

4. The children of syphilitic parents occasionally inherit syphilis.

5. The mother suckling a child with such a disease may be infected by it.

6. A healthy wet-nurse and other persons brought into contact with such a child are even more liable to be infected by it than the mother.

7. Lymph taken from such a child, even although apparently well at the time, will probably, or possibly, invaccinate syphilis.

8. In reply to the question: "Can a healthy woman give birth to a syphilitic child?" the answer must be "No."

9. Many women give birth to children who suffer from what is called "inherited syphilis," without themselves appearing to be infected. The explanation is obvious: this "inherited syphilis" is not syphilis in the true sense, and the mother's so-called escape depends upon this fact.

10. There is no recent clinical evidence which fully realizes Colles's teaching, viz.: a mother suckling her own syphilitic infant and escaping an infection to which a healthy wet-nurse suckling the same infant, and

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[1] "Some Aspects of Infantile Syphilis." Hunterian Lectures, London, 1897.

other members of her family who have merely handled this infant, have succumbed, the latter facts being essential if only to establish the contagiousness of the infant's disease in any and every given case asserted to be "inherited syphilis."

Pathological Anatomy.—*In acquired syphilis* changes are the same in the child as in the adult.

In hereditary syphilis there are certain constant changes present in the bones. These changes are confined to the shafts of the long bones and to the cranial bones.

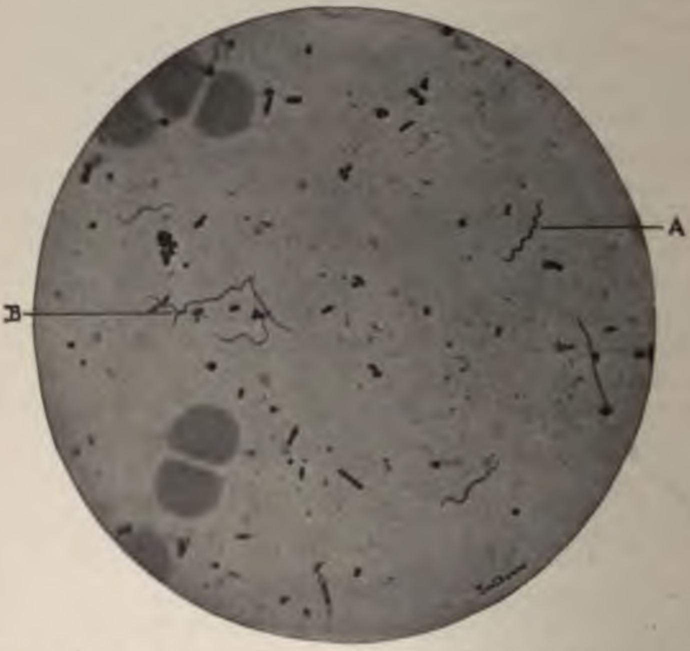

Fig. 229.—(*A*) Spirochæte Pallida; (*B*) Spirochæte Refringens from a case of Syphilis. First described by Schaudinn and Hoffmann in Berlin in May, 1905. There is no question but that the above parasites are the causative agents of syphilis. This specimen was obtained through the kindness of Dr. Boas, of Berlin. (Original.)

The pathological changes are not confined to the epiphyses, but the diaphyses are also swollen. The ends of the bones are swollen. The inner portion of the periosteum shows swelling and hyperæmia.

The circulatory apparatus shows thickening of the arterial walls as well as of the veins. Owing to this degeneration there is a tendency to bleeding. (See clinical case described in this chapter.)

Catarrhal manifestations showing implication of the respiratory tract, and also the gastro-intestinal tract, can be noted. The liver, spleen, and pancreas are enlarged.

The lymph glands of the entire body are enlarged.

Symptoms.—When catarrh is troublesome in children and not amenable to ordinary treatment, syphilis should be suspected. It is surprising to find the frequency with which nasal and nasopharyngeal catarrh is associated with syphilis. I have not yet had occasion to regret asking a direct question of a parent in whom I suspected syphilis, if such parent is told that we must know his previous history, for the benefit of his child.

Gastro-intestinal Tract.—The gastro-intestinal tract is the one that will frequently show the manifestations of syphilis. An infant will not appear to thrive nor will it digest, in spite of the most careful dietetic measures. Syphilitic lesions of the liver, pancreas, stomach, and intestine are simply all part of the infection. Anti-luetic treatment will frequently do more good in a few days or weeks than months of rigid diet. Thus it is apparent that in order to do good in this disease we must seek to remove the cause.

When a persistent diarrhœa will not respond to the ordinary treatment of careful diet and medication, then suspect syphilis. When diarrhœa such as a mucus-colitis persists without fever after careful dieting, then syphilis may be suspected.

The following case will illustrate congenital syphilis:—

An infant about one week old was seen by me. It was the fourth child of apparently healthy parents. Three children had previously died, and this fourth child was born at full term. The mother noticed that the child cried incessantly and was very restless. The child had had sniffles since birth. It was breast-fed and appeared to suffer with colic and hunger. The stools were grass-green and contained mucus and curds. The palms and soles had a pemphigus. The skin had a yellowish tinge. The nose was excoriated from the discharge. The anus had deep cracks—the so-called rhagades. Around the mouth were also rhagades. The spleen was enlarged and palpable. The lymph glands were not enlarged. The child did not seem to thrive. The finger nails showed distinct evidences of the disease. The bones of the fingers and toes showed the presence of dactylitis syphilitica. The diagnosis of congenital syphilis was made. The mother had plenty of milk, but was compelled to wean the child owing to a typhoidal condition to which she succumbed. The infant was bottle-fed, and when about five weeks old developed a large abscess on the forearm which was incised under an anæsthetic by Dr. Geo. F. Shrady. One week later a series of metastatic abscesses formed over the abdomen and on the back. The child died from inanition and general sepsis when about nine weeks old.

Hæmorrhages from the nose and mouth, and bloody stools due to ulceration of the intestinal tract are frequently reported.

Uracek has reported hæmorrhages in the different internal organs caused by syphilis in the infant. Umbilical hæmorrhages are sometimes due to syphilis, according to Rotch.

The following case will illustrate bleeding in the new-born:—

An infant suffered with a severe form of marasmus and athrepsia. It did not develop. Examination of the mucous membrane of its mouth, gums, and fauces showed distinct patches. The child was attended by Dr. Honor, of New York City, who referred the case to Dr. W. Freudenthal for diagnosis. The case was also seen by me and I concurred in the opinion expressed, that the patches were non-diphtheritic and were most likely due to syphilis. Several days later Dr. Freudenthal and myself were again called to see this child owing to an extensive nasal hæmorrhage. In spite of the most active local treatment, the use of hæmostatics, such as adrenalin, and the use of styptics internally and externally, the infant died from exhaustion. The attending physician, Dr. Honor, subsequently stated that he had found distinct evidence of syphilis.

Frequently the diagnosis must be made by a process of exclusion. This is especially true when children will not thrive and the physician cannot get a true family history from the father and mother, as in one instance known to me, where the father was a traveling man.

Skin Lesions.—The skin lesions develop soon after those of the mucous membrane. The eruption consists of small, round, pink macules, which disappear on pressure. While the eruption may be on the abdomen and lower limbs, it not infrequently is found all over the body. At times the eruption resembles an erythema and is copper-colored. Sometimes the eruption is papular; it is not infrequent to find condylomata around the mouth or anus. These condylomata are very contagious. Pustules are frequently seen as early as two months; sometimes later. This eruption can usually be differentiated from eczema by the characteristic absence of itching that always accompanies eczema. Furuncles are usually found in poorly nourished children. The infant usually has the appearance of a shriveled old man.

Specific Laryngeal Stenosis.—By this is meant laryngeal stenosis found in syphilitic children, and which is always congenital. Such cases are very uncommon and will tax the skill of many physicians.

A case of this kind was seen by me several years ago; an infant seven months old was brought to my clinic with a history of difficult breathing, restlessness, insomnia, cough, and retarded development. The child was nursing at the breast. Its body, the arms and legs, chiefly the face, the lips and the finger nails, were bluish; in fact, the child was in a condition of general cyanosis. The temperature of the child was normal, the pulse ranged from 154 to 164; it was small and feeble in character. The heart-sounds were dull; there was a blowing presystolic murmur, which was transmitted and could be heard with great distinctness in the vessels of the neck. It was looked upon as hæmic in character. An examination of the lungs gave on auscultation loud sonorous râles, which at times disappeared and gave place to normal vesicular breathing. There was no expectoration. The child had a short, explosive cough several times in a minute, which on expiration gave a peculiar croupy sound, and on inspiration made a loud, rattling, rough sound. That a constant irritation was present, was shown by the fact that the child had paroxysms of cough which did not abate night or day, and was not relieved by lying on the side, lying on the back, or by the child being held in a sitting position, or by traction on the tongue. The stomach seemed to be in a fair condition, although there was occasional vomiting. The stools were yellowish (mustard-like) in character and seemed to be thoroughly well digested. From the history of the child's mother I learned that from the first day after birth the cough had been present, which had continually grown worse, and at the time of writing was so bad that the mother determined to have it operated upon if necessary. Several attempts at a laryngoscopic examination were made, but these were all ineffectual in spite of a thorough cocainization of the parts. On introducing the finger nothing abnormal could be felt. The case was referred to Dr. C. C. Rice, and he agreed with me that we were dealing with a case of sub-glottic stenosis, which could only be relieved by a tracheotomy. Before the case was referred to several colleagues for their opinion, the diagnosis of syphilis had been made. The mother of the child stated that she had had several miscarriages and one prematurely born baby. The medicinal treatment consisted of calomel fumigations morning and evening at intervals of twelve hours, beside inunctions of mercurial ointment and calomel internally. The child was also seen by Dr. W. Freudenthal, who concurred in the diagnosis of "congenital-syphilitic sub-glottic stenosis of the larynx." It was very evident that the stenosis was too far down to be benefited by an intubation tube and thus it was referred for a deep tracheotomy to Dr. Beck at the St. Mark's Hospital.

The Teeth.—The teeth in congenital syphilis, instead of appearing at the sixth or seventh month, may not appear until the fourteenth or fifteenth month, and even later. These teeth are usually carious.

Congenital Syphilitic or Hutchinson's Teeth.—This variety of dental abnormality is important, because as Hutchinson says, "It is, if taken alone, by far the most valuable of the signs by which we recognize in adolescence the effect of inherited syphilis." The characteristics of these teeth are not sufficiently known, and abnormal and peculiar teeth of other kinds are often erroneously regarded as proofs of congenital syphilis. The main points about "Hutchinson's teeth" are as follows:—

1. It is always the permanent teeth which are affected. The temporary teeth in syphilitic infants often decay early, but they present no special peculiarities of form.

2. The only teeth which afford incontestable evidence of congenital syphilis are the upper central incisors. The first molars, the other incisors, and canines often afford corroborative evidence, but they are never to be trusted alone.

3. The characteristic peculiarities which distinguish these central incisors are as follows: They are dwarfed, being too short and too narrow; and sometimes the portion of the upper jaw from which they grow is also arrested in growth. They often stand somewhat apart and slope toward one another. They are unusually rounded on section; they are "pegged" (that is to say, the teeth are broader at the gum than at the free edge), and they are notched. The notch is usually shallow and the dentine is exposed at the bottom of it. It is formed by the breaking away of the imperfectly developed central portion of the edge. The teeth are generally

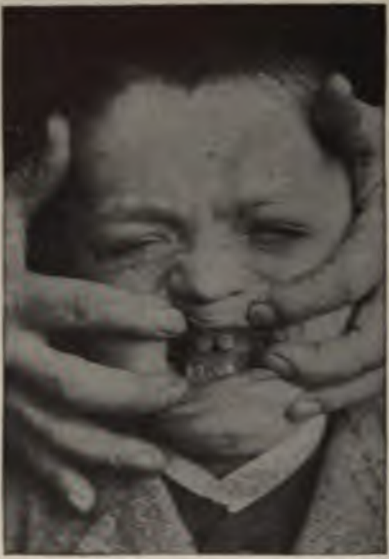

Fig. 230.

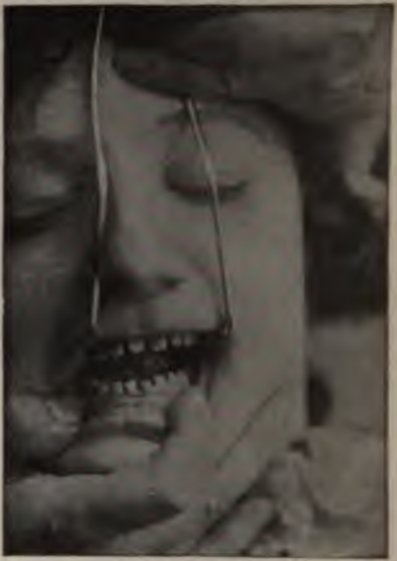

Fig. 231.

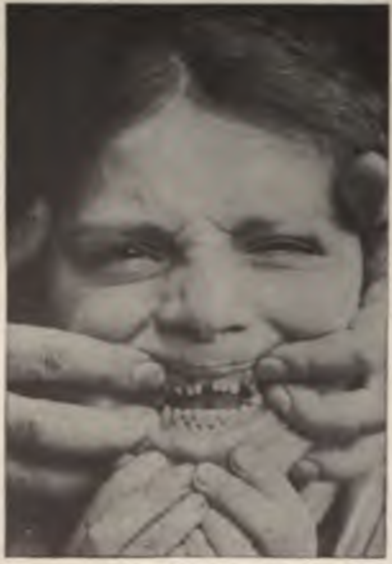

Fig. 232.

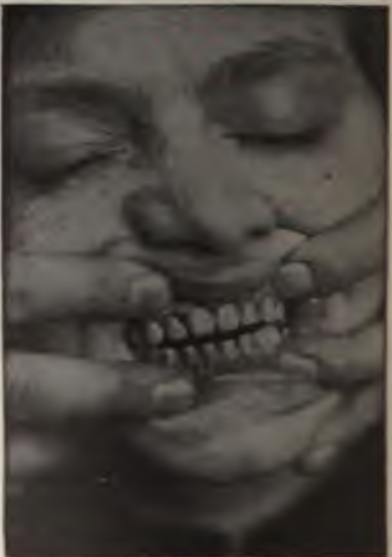

Fig. 233.

Figs. 230, 231, 232, 233.—Syphilitic Teeth. Various types of hereditary syphilitic teeth, as described by Hutchinson, also parenchymatous keratitis. Note that the upper central incisors show the positive evidence of syphilis. (Courtesy of Dr. Hugo Neumann.)

not of a good color, and they are abnormally soft, so that by the time the patient is 20 they may be ground down like those of an old man.

The first molars are next in diagnostic importance to the upper central incisors. When characteristic they are spoken of as "dome-topped." Their sides slope toward the center over which the enamel is defective. As might be expected, syphilitic teeth not infrequently present the characteristics of mercurial teeth in addition to their own peculiarities.

Diagnosis and Differential Diagnosis.—The clinical history will be the guide in congenital syphilis. The history of previous abortions and stillborn children will aid in establishing a diagnosis.

The cachectic skin, the wrinkled mouth, and rhagades at both mouth and anus will materially aid in establishing a diagnosis.

At times pseudo-paralysis will be present; sometimes coryza, hoarseness, inflamed eyes, and persistent running ears. Such children do not thrive, but appear at a standstill in their development.

When a child suffers with a persistent diarrhœa, weeks after careful treatment and dieting have been ordered, and there is no improvement, then syphilis may be suspected.

TABLE No. 95.—*Differential Points Between Syphilis and Tuberculosis.* (Morrow.)

SYPHILIS.	TUBERCULOSIS.
Exhibits a marked predilection for the long bones; its habitual localization is in the diaphysis and almost always at its terminal extremity.	Is almost exclusively situated in the epiphysis, rarely affecting the shaft.
There is a marked enlargement of the bone by more or less voluminous osseous tumors or hyperostoses, with little or no involvement of the soft parts.	The tumefaction is due less to increase in the size of the bone than to œdematous infiltration of the soft structures.
There is little tendency to suppuration and necrosis.	The pyogenic tendency is marked.
Osteocopic pains with tendency to nocturnal exacerbation are pronounced features.	The pain is dull and heavy, not aggravated at night; sometimes there is entire absence of acute painful symptoms.
The osseous lesions rarely react upon the general system.	The osseous lesions often determine a marked impairment of the general health, grave complications, hectic fever, cachexia, etc.
In dactylitis there is little involvement of the soft parts, the swelling being caused by the enlargement in the size of the bone.	In dactylitis the swelling is due more to an œdematous infiltrated condition of the soft tissues than to enlargement of the bone. Breaking-down of the tissues and ulceration are more apt to ensue.

"The diagnosis between syphilis and rachitic bone lesions may become of great importance. Epiphyseal swellings occurring under six months are apt to be syphilitic. In syphilis the epiphyseal swelling may be unilateral, but it is always symmetric in rachitis. In doubtful cases the swelling must be subjected to specific treatment. It is well to remember, however, that rickets and syphilis may co-exist in the same case. There is almost invariably enlargement at the costochondral articulations in all cases of rickets, which is absent in syphilis."

TABLE NO. 96.—*Differential Points Between Syphilitic and Scrofulous Lesions. (Morrow.)*

SYPHILITIC LESIONS.	SCROFULOUS LESIONS.
General in their distribution, they occur upon any region of the body.	Limited in their localization: they have a special predilection for the neck or regions rich in lymphatic glands.
Are ambulatory and changing; they disappear and reappear elsewhere.	Are fixed and permanent.
The color is reddish-brown, or "lean-ham" tint.	The color is brighter and more violaceous in hue.
In the initial stage the neoplasms are firm and hard.	In the initial stage the neoplasms are softer and more compressible.
In the ulcerative stage the ulcers are cleaner cut, regular in contour, with perpendicular, firmly infiltrated border encircled by a pigmented areola.	The ulcers are irregular, with soft, undermined borders; they are painless, bleed easily, and show slight tendency to spread.
The crusts are bulkier, thicker, with a tendency to accumulate in layers, and darker in color.	The crusts are softer, more adherent.
The cicatrices are smooth and remain long surrounded by a pigmented areola.	The cicatrices are elevated, irregular, bridled; they retain their violaceous color for a long time.
The course of the ulcer is sluggish and chronic.	The course of the ulcer is more sluggish.

"The absence of pain and local reaction characterize both syphilitic and scrofulous ulcers; they are essentially lesions without sensory symptoms."

Prognosis.—This depends upon the condition of the child at the time treatment is commenced. It must be remembered that such children have very little or no vitality. Hence they succumb very easily to the effects of exhaustion and inanition.

Hereditary syphilis can be transmitted to healthy children. So that the precaution of strict isolation should be remembered.

Treatment.—Heroic treatment can be instituted, even though the child may appear to have little vitality. It is surprising to note the drug tolerance of these children when mercury is given.

Local Treatment.—The safest method of administering mercury is in the form of bichloride baths. These baths can be given in a wooden tub, in which enough water is drawn to cover the child's body. From 5 to 10 grains of bichloride can be added to this tub of water. Infants up to 1 year can be bathed from ten to twenty minutes every day.

The presence of eczematous or other skin eruptions would not contraindicate giving these baths.

The inunction of chemically pure mercurial ointment well rubbed into the axillæ, knee-joints, or the thighs will materially aid in bringing this drug into the system.

For the relief of syphilitic warts nothing is better than:—

℞ Bichloride	10 parts
Alcohol	100 parts

Apply with absorbent cotton several times a day.

Internal Treatment.—Internally calomel and bichloride or the tannate of mercury can be given in suitable doses. It is advisable to give the child from 1 to 5 grains of iodide of sodium, according to age, to alternate with the mercurial treatment.

Care should be taken that stomatitis is not developed in nurslings. If, however, stomatitis has developed, then active and persistent treatment with chlorate of potash solution, locally, will be found effectual.

It is self-understood that hygienic treatment in addition to careful diet is just as important as the specific drug treatment.

Feeding.—A diet of milk, eggs, cereals, fish, and fruit should form the basis of nutrition. The reader is referred to the chapters on "Marasmus" and "Rickets" as a guide to the method of feeding necessary to reconstruct a weakened child.

PART VIII.

DISEASES OF THE BLOOD, GLANDS OR LYMPH NODES, AND DUCTLESS GLANDS.

CHAPTER I.

INTRODUCTORY.

THE BLOOD.[1]

The red corpuscles (also known as the erythrocytes). The red corpuscles of the blood are more numerous at birth than in later life. Hayem and Helot found that when the umbilical cord was not tied until its pulsations ceased, a greater number of red corpuscles were found than in cases where immediate ligation was performed. Leder and Hutchinson, comparing the new infant's blood with that of its mother, found that the blood of the infant contained a larger number of red corpuscles. The following table will show the difference in blood count by various writers:—

TABLE NO. 97.

Hayem	averaged	5,360,000
Sörensen	"	5,665,000
Otto	"	6,165,000
Bouchat and Dubrisay	"	4,300,000
Schiff (one case)	"	6,658,000
Gundobin	"	6,700,000
Elder and Hutchinson	"	5,346,560
Schwinge greatest at birth.		

The difference varies between 350,000 and 500,000 per cubic millimeter. Gundobin believed that the concentration of the blood was caused by loss of water through the lungs. Schiff found the same condition; he also states that the number of corpuscles decreases when the child is put to the breast. The number of red corpuscles begins to fall after the second day.

In one case Schiff studied the number in the morning and evening during the first fifteen days of life; he found the number declined irregularly. The first day's count was 7,628,000; the last day's count was 4,565,600; the average for the fifteen days was 5,828,465.

According to Schwinger and Gundobin there is a decrease in the number during the first year, after this there is an increase up to the eighth or twelfth year, when the number becomes approximately that of adult life. Sex makes no difference in the count of the red corpuscles in infancy.

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[1] I am indebted to Stengel and White, Archives of Pediatrics, April, 1901, for many valuable points in the preparation of this article.

Size.—The red corpuscles vary greatly in size at birth and during the first few days of life. Hayem found variations between 3.25 μ to 10.25 μ and Loos found the size varying from 3.3 μ to 10.3 μ. Gundobin claims that the hæmoglobin is more firmly attached to the cell stroma in the new-born infant. He also calls attention to the great number of small-sized corpuscles.

The Hæmoglobin.—According to Morse, Elder, Hutchinson, Taylor, and Rotch, hæmoglobin is increased at birth, but the percentage declines rapidly during the first few days of life. According to Rieder there is an excess of 25 to 30 per cent. at birth compared with infants after feeding has begun.

Specific Gravity.—This varies just like the hæmoglobin. At birth the specific gravity is high.

Monti found the specific gravity at birth	1060
Rotch found the specific gravity at birth	1065
Hoch & Schlessinger found the specific gravity at birth	1066
Moelle found the specific gravity at birth	1060

The specific gravity may not vary for weeks or months in healthy children.

The White Blood Corpuscles (Leucocytes).—Leucocytes are found in greater number at birth than in later life. This excess in number has frequently been spoken of as a normal condition. It is also called *the physiological leucocytosis of the new-born.*

TABLE No. 98.—*Table Showing the Variations in the Number of White Blood Corpuscles Found by Various Writers.*

Rieder	15,500	10 minutes after birth
Rieder	16,500	8 hours after birth
Rieder	8,700	Third day
Rieder	3 cases, 13,600	Fourth day
Rieder	2 cases, 10,500	Fifth day
Rieder	3 cases, 12,200	Fifth day
Oransky	16,980	Immediately after birth
Oransky	20,980	20 hours after birth
Oransky	31,680	44 hours after birth
Cadet	19,480	Immediately after birth
Grieffer	18,000	24 hours after birth
Elder & Hutchinson, average 12 cases,	17,884	Immediately after birth

After the second year the number gradually declines to that found in adult blood. Gundobin observed an increase of 2000 to 4000 leucocytes after feeding. The most striking peculiarity in the differential count is the increase in the number of lymphocytes and the more or less proportionate decrease in the polymorphonuclear cells.

Gundobin gives the following figures: Lymphocytes, 50 per cent. to 66 per cent.; polymorphonuclear, 28 per cent. to 40 per cent. The weight of the child has no influence on the total number of leucocytes or on the proportions of the different forms.

Pathological Conditions.—In disease the first change noticed will be a reduction in the percentage of hæmoglobin, and also in the number of erythrocytes. There are smaller forms of red corpuscles called microcytes.

Nucleated Red Corpuscles (Erythroblasts).—These cells have been found in primary and secondary anæmias by many observers. They have also been found very abundant in syphilis, rachitis, tuberculosis, pseudoleukæmia, and osteomyelitis.

Leucocytosis.—In leucocytosis an increase in the number of leucocytes is found in the blood of anæmic children. It is also found in toxic and inflammatory conditions. Myelocytes are more frequently found in the blood of children than in adults. Cabot and Engel ascribe a bad prognostic significance in pneumonias and diphtherias to their presence.

Infectious Diseases.—In diphtheria, scarlatina, pneumonia, and erysipelas the polymorphonuclear cells are greatly increased (Weiss and Gundobin). Gundobin found an increase in the number of leucocytes before the eruption in scarlet fever, measles, and erysipelas. In typhoid fever the number of leucocytes is decreased; there may be also a decrease in the number of red corpuscles and in the percentage of hæmoglobin. The number of leucocytes is relatively increased. The polymorphonuclear cells do not vary in number.

Pneumonia.—Leucocytosis is usually present in this disease. When it is absent the prognosis is grave.

Syphilis.—In hereditary syphilis an anæmia is found with a decrease of the red corpuscles and great degenerative changes (poikilocytosis). In syphilis we find microcytes and macrocytes and nucleated erythrocytes. Myelocytes are also found. Eosinophiles are also met with in this condition.

Bronchitis.—A slight leucocytosis with especial increase of the lymphocytes or mononuclear cells.

Gastro-intestinal Disease.—The condition of the blood varies according to the extent of the process, the duration, and the existence or nonexistence of diarrhœa and vomiting. Profuse diarrhœa and vomiting may for a time thicken the blood by loss of water. Weiss shows an increase of the leucocytes and transitional leucocytes.

Rachitis.—There is usually a reduction in the number of red corpuscles, a decrease in the percentage of hæmoglobin, and an accompanying leucocytosis according to von Jaksch.

Skin Diseases.—There is an increase in the number of eosinophiles. The cause of the same is unknown.

Nervous Diseases.—In the functional disorders of childhood the blood findings are those of a moderate anæmia. Burr has found that the blood in chorea is not as a rule anæmic. In my own examinations (Fischer) the opposite result has been found, and I believe that in prolonged chorea a distinct leucocytosis can be found.

The following table, prepared by Casper Sharpless, will assist in the differentiation of the blood:—

TABLE NO. 99.

Disease.	Leucocytosis.	Lymphocytes.	Neutrophiles.	Red Cells.	Hæmoglobin.
Typhoid Fever	Absent	Relatively increased	Decreased	Decreased	Proportionately decreased
Typhoid with complications	Present		Increased	Decreased	Proportionately decreased
Scarlet fever .	Present	Decreased	Increased	Decreased	Proportionately decreased
Measles. . . .	Absent			No change	No change
Small pox . .	Marked on third day		Increased	Much decreased	Proportionately decreased
Erysipelas	Marked		Increased	Decreased	Proportionately decreased
Diphtheria . .	Marked	Rarely increased	Increased	Slight decrease	Proportionately decreased
Influenza. . .	No change			No change	No change
Typhus fever	No change			No change	No change
Follicular tonsillitis	Moderate			No change	
Acute rheumatism .	Moderate		Increased	Markedly decreased	Markedly decreased
Septicæmia . .	Marked		Increased	Markedly decreased	Proportionately decreased
Abscess. . .	Marked		Increased	Decreased	Proportionately decreased
Meningitis	Marked		Increased	Slightly decreased	Proportionately decreased
Peritonitis	Marked		Increased	Slightly decreased	Proportionately decreased
Pericarditis .	Marked		Increased	Slightly decreased	Proportionately decreased
Pleurisy	Marked		Increased	Slightly decreased	Proportionately decreased
Malaria . .	Absent	Relatively increased	Decreased	Decreased	Proportionately decreased
Pneumonia[1] .	Marked	Decreased	Increased	Decreased	Proportionately decreased
Appendicitis	Marked				

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[1] In pneumonia there is a decrease of the eosinophiles and in scarlet fever an increase.

Blood Reaction of Pus.—The glycogenic reaction of the blood has frequently been described in literature. The first complete paper on this subject was published by Dr. M. Goldberger and Dr. Siegfried Weiss.[1] This diagnostic aid is of value when a questionable diagnosis exists.

Through the courtesy of Dr. Knoepfelmacher, physician in charge of the Carolinen Children's Hospital, in Vienna, I saw the value of this reaction. In differentiating abdominal symptoms pointing to a typhoid fever or a suppurative appendicitis, we have an important diagnostic guide in using this blood reaction.

FORMULA FOR STAINING.

℞ Iodin sublim.	7 1/2 grains
Kal. iodati	22 grains
Aquæ destil.	1 ounce, 1 scruple.
Muc. acaciæ, ad consist. syruposam.	

The reaction is based on the following:—

1. The polynuclear neutrophile leucocytes contain very many irregular granules of glycogen. These have a brownish color, sometimes a reddish-brown color.

2. Mononuclear leucocytes usually contain large granules of glycogen. Besides the above, yellowish-brown stained extra cellular masses showing the glycogenic reaction are also found.[2]

Method of Taking a Blood Smear.—When fever exists and the diagnosis is obscure, the blood should be examined. A drop of blood can be withdrawn from the tip of the finger or the lobe of the ear. All rules of asepsis should be strictly applied. The needle can be passed through an alcohol flame or a Bunsen burner, the finger or ear quickly pricked, and the drop of blood thinly smeared over the cover glass.

When plasmodia are present then malaria can be diagnosed. The *Widal reaction* is usually indicative of typhoid, if other symptoms warrant the diagnosis. (See illustration of *Widal reaction* in chapter on "Typhoid.")

Antibacterial Action of the Blood.—According to Halliburton[3] "the power of the blood to destroy bacteria was first discovered when an effort was made to grow various kinds of bacteria in it; the blood was believed to be a suitable soil for this purpose, but it was found to have the opposite effect in many instances. The chemical characters of the substances which kill the bacteria are not fully known. Evidence appears to favor the leucocytes as the origin of this bactericidal substance. These substances are called alexins, but the more usual name now applied to them is that of

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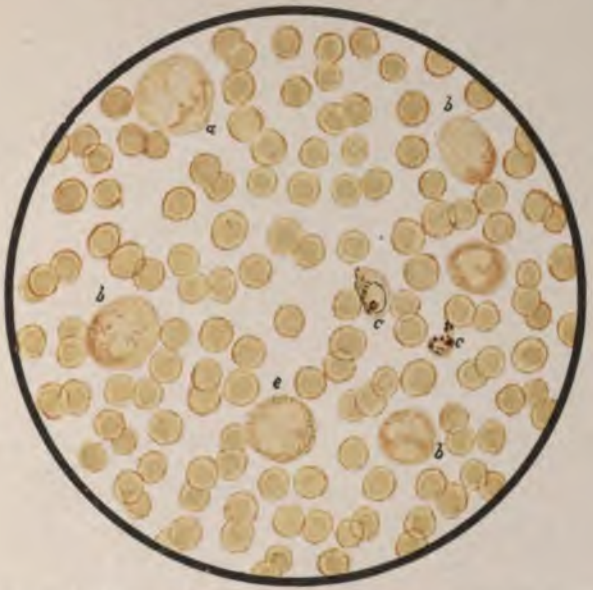
[1] Wiener Klinische Wochenschrift, No. 25, 1897.

[2] An interesting contribution on this subject is found in the Transactions of the Section on Pediatrics of the American Medical Association, June, 1900, by Dr. Siegfried Weiss.

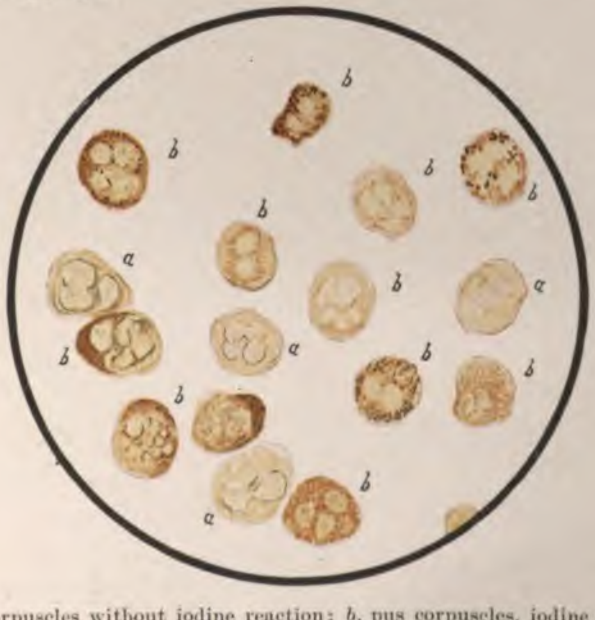
[3] Paper read before the British Association for the Advancement of Science.

PLATE XIX

IODOPHILIA. PUS REACTION OF BLOOD.



Coverglass Specimen of Blood in a Case of Suppurative Appendicitis. *a*, Polynuclear leucocytes; *b*, polynuclear leucocytes containing many irregular granules of glycogen; *c*, extra-cellular iodine-stained masses, giving the reaction of glycogen.



a, Pus corpuscles without iodine reaction; *b*, pus corpuscles, iodine reaction. (Original.)

bacteriolysins. The bactericidal power of the blood is closely related to its alkalinity. Increase of alkalinity means increase of bactericidal power. Alkalinity is probably beneficial, because it favors those oxidative processes in the cells of the body which are so essential for the maintenance of healthy life. Normal blood possesses a certain amount of substances which are inimical to the life of bacteria. When a person gets run down there is a diminution in the bactericidal power of his blood. However, a perfectly healthy person has not an unlimited supply of bacteriolysin, and if the bacteria are sufficiently numerous he will fall a victim to the disease which they produce. In the struggle he will form more and more bacteriolysin, and if he gets well it means that the bacteria are vanquished, and his blood remains rich in the particular bacteriolysin he has produced, and so will render him immune to further attacks from that particular species of bacterium. Every bacterium seems to cause the development of a specific bacteriolysin. Immunity can more conveniently be produced gradually in animals, and this applies, not only to the bacteria, but also to the toxins they form."

The Blood in Fever.—There is a decided reduction in the number of red cells during fever. Whether the fever destroys the red cells or causes them to be unequally distributed in the body is the question. Maragliano demonstrated a contraction of arterioles during the height of a febrile process, followed by dilatation during defervescence. He was able to verify these results by noting the effect of antipyretics (Ewing).

Salkowski demonstrated an excess of potassium in the blood during fever, thus favoring the view that the red cells are destroyed. Senator, Von Jaksch, and others have shown that febrile processes are regularly marked by diminished alkalescence of the blood. When diphtheria antitoxin is injected the alkalinity of the blood is increased for about twenty-four hours.

The progressive *loss of albumin* is probably associated with every fever, but occurs in a marked degree when the fever is of an infectious origin. Diminished resistance of the red cells occurs in the majority of fevers and depends on a variety of factors. Variations in alkalinity are frequent and considerable in fever, but are not proportional to either the toxicity or to the height of the temperature (according to Ewing).

The question is, why do almost all micro-organisms which are harmful to the body raise its temperature, and the suggestion has been made that the rise of temperature is a defensive mechanism, or, in other words, pyrexia is like phagocytosis or chemiotaxis, in some way harmful to the fever-producing micro-organisms or their toxins. It does not follow from this view that the higher the temperature of the body the better the prognosis, for the higher temperature might be taken to indicate that the dose of infection was very severe, and that, therefore, the body did all it could to resist the invasion; nor, on the other hand, would it follow that if the temperature did not rise much, the dose of infection was slight, for it might be that the body was feeble and had but little power of raising its temperature, and therefore defending itself.

Some years ago much was expected from the antipyretic drugs—antipyrin, acetanilid, and phenacetin; and if it could have been shown that they distinctly improved the condition of the fevered patient it would have been a strong argument against the view that pyrexia is a defensive mechanism.

When fever arises and a distinct diagnosis cannot be made, the child should be put on *the expectant plan of treatment.* This will consist in cleansing the gastro-intestinal tract, regulating the diet, and noting symptoms as they arise. This is especially indicated when we believe the case to be, in the period of incubation, of an infectious disease. At such times the following recipe is a good antipyretic and will not depress the heart:—

℞ Sweet spirits of niter	1 1/2 fluidrachms
Citrate of potassium	30 grains
Syrup of lemon	4 fluidrachms
Aquæ q. s. ad	2 fluid ounces

A teaspoonful every three hours, for child 1 year old.

It is generally believed, and in all probability correctly, that many cases of typhoid fever are benefited by cold sponging or by a cool bath. Many have hastily concluded that the bath does good because it lowers the temperature. But this is probably incorrect. In the first place we must remember that the cold sponging or bath does more than lower the temperature; it diminishes the delirium, the tremor, and the prostration. In any of these ways it would do good. But, further, Roque and Weil claim to have shown that "in typhoid fever left to itself the toxic products manufactured by the bacillus and organism are eliminated in part during the illness. The urotoxic coefficient is double the normal, but this elimination is incomplete and is only completed during convalescence, for the hypertoxicity continues for four or five weeks after the cessation of the fever. In typhoid treated by cold baths the elimination of toxic products is enormous during the illness. The urotoxic coefficient is five or six times the normal. The hypertoxicity diminishes as the general symptoms mend and as the temperature falls, so that when the period of pyrexia and convalescence sets in the elimination of toxins has ceased." So we learn that it is by no means certain that in typhoid fever the benefit of cold baths is due to their antipyretic influence alone, but also to the elimination of toxins. We see that clinical medicine affords no evidence that antipyretics are useful in fever.

CHAPTER II.

DISEASES OF THE BLOOD.

ANÆMIA.

A DEFICIENCY in the number of red blood-cells or of the hæmoglobin is known as anæmia. As a rule there are two distinct forms: first, congenital; second, acquired.

Congenital Form.—The fœtus in utero is frequently anæmic owing to the inherited disease of its mother. Such diseases are blood disorders like syphilis, or where a general devitalization occurs, as seen in tuberculosis. If the mother while pregnant passes through a severe form of diphtheria, typhoid fever, or any other infectious disease, it may result in anæmia of her offspring.

Malarial infection of the mother may also result in an anæmia of the baby. A severe hæmorrhage due to an operation on the mother during the last period of her pregnancy may cause an anæmia of the baby.

Acquired Form.—This form is due to either an infection of the baby or to toxic conditions acquired after birth and independent of the mother. Most cases of acquired anæmia seen by me are the direct result of malnutrition. I have referred in detail to this condition in the chapter on "Scurvy" and "Rachitis."

SPLENIC ANÆMIA.

"It is evident that some of the cases now classified as pseudo-leukæmic anæmia belong to the group of the simple, severe, chronic anæmia of young children—splenic anæmia. Others, possibly, should be classed as leukæmia, but cases observed at Heubner's clinic indicate that although the blood presents the leukæmia formula, the affection may terminate in recovery. Alterations in the red corpuscles, especially the appearance of megaloblasts, should be considered pathologic in young children. The total number of leucocytes and the proportion of lymphocytes in this splenic anæmia are normally larger than usual. A polynuclear leucocytosis may be transient. The severe forms of anæmia in children are invariably accompanied by an enlargement of the spleen, but it may be enlarged also in mild anæmia, and also in its absence. The 26 cases described by Geissler and Japha demonstrate the existence of this disease of the blood in young children, especially in those with rachitis. It ranges from a slight decrease in the hæmoglobin and the number of the reds to the appearance of megaloblasts."

SECONDARY ANÆMIA.

Causes.—Toxic influences frequently destroy the blood corpuscles and also the hæmoglobin, hence anæmia results. When hæmorrhage takes place then anæmia frequently follows. Malaria and whooping-cough seem to affect children more than adults. Other diseases, such as rheumatism and endocarditis, in fact, most of the acute infectious diseases, cause anæmia. Improper hygiene, and more frequently improper food, should not be overlooked as causative factors.

Symptoms.—A pale white skin and waxy appearance of the nails is the usual clinical picture. Children do not appear bright. They take no interest in their surroundings, and do not wish to play. Loss of appetite and tendency to constipation frequently exist.

Diagnosis.—This is usually determined by the condition of the blood.

Prognosis.—The origin of the anæmia should be the guide in determining the outcome of this condition. Great care should be used in venturing an opinion, unless we are sure of the origin and can remove the cause of same.

Treatment.—Fresh air, food (chiefly proteids), and restoratives, such as codliver-oil, lipanin, iron, Fowler's solution, and malt preparations, are indicated. Wine or champagne is sometimes valuable.

PERNICIOUS ANÆMIA.

This rare condition is sometimes seen in children.

Etiology.—It may follow simple anæmia so that it would appear as the result of a continuation of malnutrition. Many theories are offered. Tape-worm, syphilis, and rachitis are believed to be the factors causing this condition.

Pathology.—Hunter first reported the presence of a deposit of iron in the hepatic cells. There is also an anæmia of the internal organs. Sometimes capillary hæmorrhages are seen in the various organs. Fatty degeneration is also described as a frequent pathological finding.

General Symptoms.—These are the same as previously described in the article on anæmia, although all symptoms are of a more severe type. Epistaxis, in addition to local purpuric spots, denotes the tendency to hæmorrhages. An interference of the return circulation to the heart is manifested by œdema of the feet and ankles. The urine contains neither albumin nor casts.

Special Symptoms.—The blood will furnish the real means of diagnosis. The hæmoglobin may sometimes be as low as 20 to 30 per cent. The erythrocytes are reduced in number; 2,000,000 is a fair average red blood count in this condition, although Lenhartz[1] refers to a reduction of

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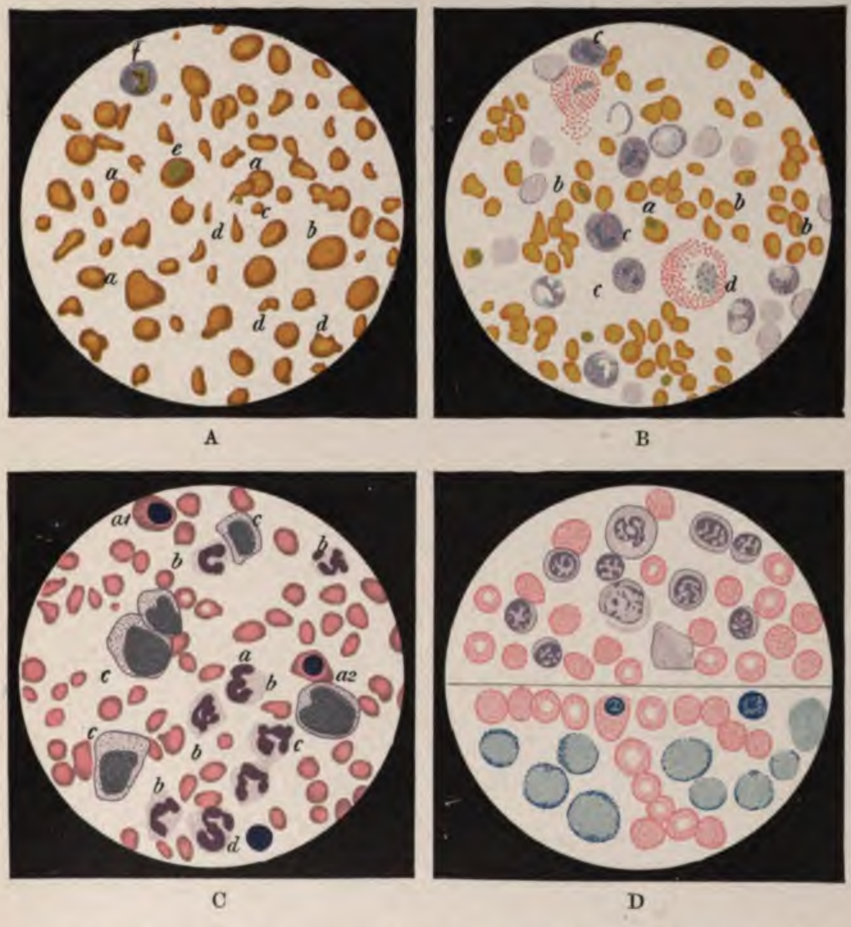
[1] Lenhartz—"Clinical Microscopy," page 156. F. A. Davis Co., 1904.

PLATE XX



A B

C D

A.—Progressive Pernicious Anæmia. The case ended fatally in six weeks; cause unknown; possibly in connection with typhoid fever. Ehrlich's triacid stain. Zeiss ocular 1, oil immersion $^1/_{12}$. *a*, normal erythrocytes; *b*, megalocytes; *c*, microcytes; *d*, marked poikilocytosis; *e*, megaloblast; *f*, polynuclear neutrophilic leucocyte. (Lenhartz-Brooks.)

B.—Lienal (Splenic) Leukæmia. *a*, normal erythrocyte; *b*, nucleated erythrocyte, nucleus eccentrically situated; *c*, polynuclear neutrophilic leucocytes; *d*, eosinophilic (myelo) cell. The eosinophilic cell at the top has been ruptured and the granula dispersed. Two small greenish-blue nuclei, perhaps small lymphocytes. (Lenhartz-Brooks.)

C.—Lienal (Splenic) Leukæmia. *a1*, megaloblast; *a*, normal erythrocyte; *a2*, megaloblast, with anæmic degeneration; *b*, polynuclear leucocytes; *c*, "marrow cells" (myelocytes); *d*, large lymphocyte. (Lenhartz-Brooks.)

D.—Acute Leukæmia. This picture is made from two different, rapidly fatal, clinically similar cases. The upper portion is stained with Ehrlich's stain with eosin-hematoxylin; the lower portion is stained with the Plehn-Chenzinsky's stain. (Lenhartz-Brooks.)

erythrocytes as low as 400,000 to 800,000. There is also an enormous poikilocytosis.

In this disease there is a greater reduction in the number of red blood cells (oligocythæmia) than in any other disease.

LEUKÆMIA (LEUKOCYTHÆMIA).

In this condition we have a reduction of the red corpuscles and a corresponding increase in the white blood cells.

Cellular forms called lymphocytes not otherwise found in health are present in the blood. Virchow calls this condition "white blood." Ehrlich calls it a leucocytosis of a chronic type.

Etiology.—This is unknown. Some authors, Roux and Lowit, describe asporozoa in the blood as well as in the leucocytes and in the spleen. Other writers believe that there is a predisposition in syphilitic and rachitic children. Unsanitary surroundings and injury to the spleen are decided etiological factors.

The following classification is given by Ehrlich:—

(a) Lymphatic forms.

(b) Myelogenous and splenic forms.

Lymphatic Form.—When the colorless corpuscles are as large as a normal erythrocyte then an involvement of the glandular system can be diagnosticated.

Myelogenous and Splenic Forms.—If large cells appear then bone-marrow and the spleen evidently participate. When large mononucleated leucocytes are found then the bone-marrow is probably involved. If, in the field of the microscope, three to five or more cells filled with strongly refractive spheroid granules are found, the splenic involvement should be suspected.

Pathology.—The lesions are confined to the bone-marrow, lymphatic glands, and spleen. *The spleen is enormously enlarged,* sometimes filling half of the abdominal cavity. Sometimes it is soft, and at other times very hard on palpation. It has a dark red color. In the lymphatic form any or all of the external glands of the body may be affected; thus the cervical, maxillary, bronchial, mesenteric, or inguinal glands may be involved. There is a simple hyperplasia found in the glands. The liver is usually enlarged from an infiltration with lymphoid tissue. The lymphoid tissue in the tonsils and the thymus gland have the same changes. Hæmorrhages are not infrequent.

Symptoms and Diagnosis.—The disease is usually ushered in by a severe hæmorrhage, after which profound anæmia and a general weakness are noted. The spleen is always enlarged and the lymphatic glands are palpable. The glands are movable, but never tender on palpation. The liver is usually enlarged. In the beginning there is little or no fever, although later in the disease the temperature may rise as high as 103° F. Sometimes from involvement of the liver there will be dropsy of the feet or a general anasarca. Hæmorrhages from the nose, mouth, stomach, and bowels frequently complicate this condition. From the loss of blood fainting spells may occur.

The Blood.—The characteristic feature is an increase in the number of leucocytes. The normal ratio between the red and white corpuscles varies between 1 to 500 and 1 to 1000. In leukæmia the ratio is so altered that we may have one colorless corpuscle to twenty, or even to five, red corpuscles. Some authors report a ratio of one red to two white corpuscles.

The eosinophiles are frequently increased many times their normal number. A characteristic feature is the presence of large and small mononuclear lymphocytes. Ehrlich describes a large mononuclear nutrophilic staining cell which normally exists in the bone-marrow, and is found in the myelogonous form of leukæmia. It is called the myelocyte.

Treatment.—The nutrition of the child must be carefully considered. Albumin and the cereals should form the main portion of the food. All vegetables should be ordered. If the child can be taken out of doors, then the same should be insisted upon. Strict attention to hygienic details will greatly assist in modifying this condition.

Medication.—Iron, arsenic, in the form of Fowler's solution, cod-liver-oil, and malt extracts should be given. If there is anorexia then strychnia or nux vomica should be given.

PSEUDO-LEUKÆMIC ANÆMIA OF INFANCY (ANÆMIA INFANTUM PSEUDO-LEUKÆMICA).

Von Jaksch was the first to describe this disease in 1889. It is an infantile anæmia characterized by the following conditions:—

1. There is a marked enlargement of the spleen.
2. A slight enlargement of the liver and the lymph nodes.
3. A marked reduction in the number of red corpuscles.

It is usually a secondary anæmia rather than a primary disease.

Etiology.—The disease is usually found in infants and children between 6 months and 4 years of age.

Monti and Berggrun collected 16 cases in 1892. Rickets, congenital syphilis, chronic intestinal catarrh, and tuberculosis were found in cases collected by Fischl.

Pathological Anatomy.—The spleen is enlarged and rather firm. Histologically, the changes are those of simple hyperplasia of all elements, while the sinuses contain no excessive number of leucocytes. Baginsky found many eosinophile cells in the spleen. The changes in the viscera are described by Von Jaksch, Eppinger, Luzet, Baginsky, Audeoud, and Rotch.

The marrow, according to Luzet, is diffusely reddened and moist and shows evidence of excessive multiplication of the red cells.

The Blood.—Leucocytosis is an important symptom. The white blood cells number between 20,000 and 50,000. Other cases (Baginsky) between 40,000 and 122,000.

According to Monti the proportion of white cells to the red may be as 1 to 100 or 1 to 15.

Symptoms.—After a prolonged gastro-intestinal disease an infant will appear very anæmic. Fever is not usually present. When fever is present the cause of the same will usually be found other than in the spleen. Icterus is sometimes present.

There is a decided loss of appetite and the bowels move sluggishly. The skin has a yellowish color and is intensely anæmic. The abdomen appears distended. The liver is slightly enlarged. The lymph glands are palpable. The spleen is very much enlarged and occupies the left hypochondrium, reaching at times to the crest of the ilium.

Prognosis.—The prognosis is poor, although recovery does take place in some instances. A case of this kind seen by me has shown marked improvement under anti-rachitic and restorative treatment.

Treatment.—Tonic doses of iron, quinine, and strychnine served me well. Codliver-oil and the glycerophosphites of lime and soda are indicated. Phosphorus has been recommended by some. The bowels must be thoroughly cleansed, and the general peristalsis stimulated. Nux vomica, in 1 minim doses three times a day, when anorexia and gastric atony are present. Fresh air and general hygienic management, in addition to a supporting diet, will do more toward building up and restoring the system than all medication combined.

CHLOROSIS.

This is a primary anæmia which is usually found in girls at or about the period of menstruation. In our climate chlorosis can be seen between the twelfth and twentieth years of age. Blondes are more prone to this disease than brunettes.

Etiology.—Sedentary occupation associated with lack of exercise, or poor hygienic surroundings, may induce this condition. Nervous girls susceptible to mental influences, such as fright or worry, are more prone to the development of this condition than robust, healthy girls. Auto-intoxication is certainly a factor, as I have frequently seen chlorosis in girls suffering with chronic constipation.

Pathology.—Distinct pathological lesions cannot be attributed to this condition. In some cases ulcer of the stomach is associated, and this latter condition may be fatal.

Symptoms.—The symptoms are those described in the chapter on "anæmia." The appetite is poor and such girls invariably crave for sour and spiced foods to stimulate the appetite. Constipation is most always present. Headache and other nervous symptoms are also present. Such girls are very emotional, and cry and laugh very easily. They are very sensitive. A venous murmur can usually be made out in the vessels of the neck. There is a blowing systolic murmur which can be heard over the heart in the mitral region and also in the region of the pulmonary artery. Venous thrombosis is most frequently seen in the femoral veins, and varicose veins are sometimes seen over the thighs and ankles. Menstruation is irregular and the flow is scanty or very profuse and sometimes painful. There is a decrease in the percentage of hæmoglobin and also a decrease in the number of red corpuscles. The number of red cells may be reduced to 4,000,000.

The spleen may be slightly enlarged, but on this symptom no reliance can be placed. A puffiness of the face or œdema of the ankles due to a sluggish return circulation is occasionally seen.

The skin is of a greenish-yellow color. When localized areas of pain are complained of in the region of the stomach, then gastric ulcer should be suspected. In such cases an examination of the gastric contents should be made with the aid of a test-meal (see page 915, Part XII), to see whether or no hyperacidity is present. The eyes usually have a peculiar pearly sclerotic appearance.

Diagnosis.—Chlorosis is met with in girls only at or about the period of menstruation. This is its characteristic diagnostic feature. Such children, as a rule, are fat and look well nourished.

Prognosis.—This is always good, although the disease may last several years. If chlorosis is a forerunner of tuberculosis or gastric ulcer, then a fatal termination may occur. The outcome of a case depends on heroic restorative treatment.

Treatment.—*Hygienic Treatment:* Remove the child from its immediate surroundings, from the city to the country. If chlorosis occurs in a girl living at a boarding-school, in a convent, or in a girl working in a factory, the hygienic conditions demand:—

1. To sleep in an airy room with the windows open at night.

2. Discontinue working, or studying if at school, to procure mental rest.

3. Change the entire mode of living, so that there is neither care nor worry for the chlorotic girl.

Exercise.—Gentle exercise, walking, swimming, the lighter exercises of physical culture followed by a shower-bath and massage are valuable. Friction with a coarse towel after the daily sponge bath is useful to stimulate the circulation. Reading or sewing at night must be forbidden.

Nutrition.—To stimulate metabolism nothing equals food. Proteids in the form of milk, meat, eggs, cereals, cream, butter, and cheese should be liberally given. All fresh fruits may be allowed. Regularity in feeding must be demanded, although a drink of milk, buttermilk, cocoa, or zoolak may be taken between meals.

Medicinal Treatment.—Soluble preparations of iron, such as ovoferrin and neoferrum, may be given in teaspoonful doses after each meal. Arsenic in the form of Fowler's solution or arsenious acid may be combined with the iron. The arseniated hæmaboloids have been tried by me with good result. Maltine with or without hypophosphites may be tried three times a day. Codliver-oil, morrholine, or lipanin may be tried in teaspoonful doses three times a day given after meals. The sun bath or the electric light bath may be tried in conjunction with the above-described treatment.

CHAPTER III.

ACUTE RHEUMATISM (POLYARTHRITIS).

This disease is sometimes known as rheumatic fever, also as inflammatory rheumatism. It is an acute, infectious, but non-contagious disease. The infection is characterized by an inflammation which localizes in the joints, and travels from joint to joint, evidently through the circulation. The most frequent complication is endocarditis.

Etiology.—The specific factor is evidently a micro-organism. A great many observers have studied this subject, among them, Leyden, Sahli, Achalme, Riva, Triboubet, Coyon, Singer, Jaccoud, and many others. A bacillus described as an anærobic, with more or less motility, similar to the anthrax bacillus, has been described by Achalme. This bacillus, when injected into animals, has reproduced symptoms resembling rheumatism. Thus this observer believes he has found the specific agent causing this disease.

Other causes have been described as the result of defective assimilation, which produces lactic acid or combinations of it. Another theory is the so-called *nervous theory*, in which the nerve centers are primarily affected by cold, and the local lesions are atrophic in character.

This nervous disturbance brings about hurtful metabolism, so that the nitrogenous products, instead of being converted into urea, are transformed into uric acid and other poisonous products which cause these symptoms.

Whether or not heredity bears any relationship to the cause of this disease may be considered by the fact that in two-thirds of the cases, diseases of a similar type can be traced to the ancestors. Gouty parents will usually have rheumatic children. The disease is very common in children, and has also been observed in nurslings.

Rheumatism occurs more often in the spring of the year. When the disease has commenced, it usually lays the foundation for future attacks; in other words, one attack of rheumatism predisposes to future attacks of the disease.

The tonsils have frequently been looked upon as the seat of entrance of this disease; thus acute tonsillitis has frequently been followed by acute articular rheumatism. In the same manner endocarditis has frequently followed an attack of tonsillitis. It is therefore safe to assume that the specific entrance of an infection can originate in a diseased tonsil.

Packard has described a series of cases of endocardial inflammation following tonsillitis. He regards a serous inflammation as due to the germs or other toxins entering the circulation through inflamed tonsils.

Bacteriology.—Triboulet and Coyon[1] give the results of their bacteriologic examinations in 11 cases of acute articular rheumatism. They discovered in all these cases a diplococcus or diplobacillus which they state cannot be well described as to its cultural peculiarities, as its growth is so irregular.

The organism exhibits great plesiomorphism and resembles most closely in character the diplococcus pneumoniæ, but differs from it in that it can be kept alive for a considerable length of time, and that it is not pathogenic for mice. The organism is extremely pathogenic for rabbits, and the authors give a detailed account of its effects on a rabbit. The animal died twenty days after intravenous inoculation. Death was due to heart failure resulting from an absolute mitral insufficiency. During life there was an oscillatory temperature. The autopsy showed fresh pleuritis and pericarditis, and an acute vegetative endocarditis with tremendous masses of vegetations on the mitral valve. The vegetations microscopically showed many diplobacilli similar to those originally inoculated, and cultures from the organs also showed it. Other rabbits inoculated with smaller doses from other cases showed irregular fever, disturbances of the heart, and pleurisy, but did not die.

Symptoms.—The symptoms are entirely different from those met with in adults. The fever is not so high, usually between 100° and 102° F. The swelling of the joints is moderate, and there is not the redness and inflammation visible to the eye as we see it in adults. The pains are not severe in all cases, and there are less joints involved as a rule than we find in adults. We therefore meet with a great many cases of rheumatism that walk around suffering slight pains. Sometimes the lower extremities are affected, at other times the disease is limited to the upper extremities. A child may walk apparently lame or an infant may cry when put on its feet. Jacobi years ago directed the attention of the profession to the necessity of carefully watching every case of so-called "growing pains." He believed, and correctly so, that the majority of these cases were in reality rheumatism. The most frequent symptoms are vomiting, fever, general malaise, anorexia, in addition to multiple arthropathy.

Rheumatism a Sequela to Tonsillitis.—That rheumatism is frequently a sequel to tonsillitis has been noted by many observers. Packard, of Philadelphia, has reported a series of cases in which the throat was first affected and later heart disease was distinctly manifested. Emil Mayer, of New York City, has also reported a series of cases in which the tonsils were the portals of infection. This is certainly not a theory when we study the primary infection and follow it up with its secondary result.

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[1] Comptes Rendus de la Societé de Biologie, February 4, 1898.

Sir Willoughby Wade[1] says, in relationship between tonsillitis and rheumatic fever, he believes that tonsillitis is a primary infective disease of the lacunæ; rheumatic fever a secondary disease arising from the absorption of microbes or their products into the system. Knowing this to be a factor, it would only seem proper to treat every tonsillitis as vigorously as possible.

Acute Contagious Articular Rheumatism.—G. B. Allari reports 3 cases which were characterized by contagiousness and at the beginning of the disorder with angina of the throat. In the fourth case the angina reappeared with every reappearance of exacerbation of the articular symptoms. Bacteriological investigations of the exudate on the tonsils showed in each case a streptodiplococcus which was almost identical in structure and behavior with that found by Mayer in the same affection. Animals inoculated with this micro-organism developed lesions in the joints.

Subcutaneous Tendinous Nodules.—Barlow and Warner described this manifestation of rheumatism in 1881 as oval semi-transparent fibrous bodies like boiled sago grains. They are most frequently met with at the back of the elbow, over the malleoli, and at the margin of the patella. Occasionally on the extensior tendons of the hands, fingers, and toes, or over the spinous processes of the vertebræ. They are composed of fibrin, cells, and fibrous tissue. They vary in size from a pin-head to a small bean, though sometimes being as large as an almond. They may remain for months, although they frequently disappear in a few weeks. Cheadle states that they can be seen if the skin is tightly drawn. Cheadle has also shown the intimate relationship between *erythema and rheumatism.*

Purpura.—This is frequently met with in the course of rheumatism. It is a rash of a deep purplish hue and is most probably a result of rheumatism.

Complications.—The most frequent form of complication is endocarditis. Fully 75 per cent. of my cases met with in a large outdoor practice showed this form of complication. This complication has frequently been the first symptom that led to the discovery that our patient had rheumatism.

Pericarditis is rarely seen in children under 7 years of age. It is usually associated with endocarditis.

Pleurisy, peritonitis, or meningitis may complicate rheumatism. Chorea frequently associates itself with rheumatism, so that a great many authors believe that there is an intimate relationship between rheumatism and chorea.

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[1] British Medical Journal, 1898.

Holt states that in a series of cases of chorea observed by him, 56 per cent. gave evidence of the rheumatic diathesis.

Prognosis and Course.—The course of rheumatism depends on the treatment. Pains in the joints should never be regarded as a trivial matter. How frequently do we see a child suffering with what the mother calls "growing pains," and a few weeks or months later we note shortness of breath due to heart trouble, usually endocarditis. It is *better to put a child to bed* than to run risks of such a serious complication. The prognosis depends on the care bestowed, although we know that this disease has a tendency to assume a chronic course. However, a case with proper treatment should recover entirely. The inflammatory stage lasts from ten days to two weeks. Cases of inflammatory rheumatism complicating scarlet fever or diphtheria lasting between three and eight weeks have been seen by me during my hospital service.

Rheumatism in children assumes the course of a general infectious malady. The intensity of cardiac complications cannot be approximated by the intensity or mildness of articular manifestations. Many authorities state that the percentage of cardiac complications is between 81 and 87 per cent.

Lethal termination will frequently show pericarditis, hence the important deduction is to prevent such complications, if possible, by proper prophylactic treatment.

Treatment.—The first thing to do is to put the child in bed. The patient should be kept in bed until every particle of pain and fever is gone.

1. When the disease is localized we can treat the same and try to destroy as much of the pathogenic infection as possible.

2. The important point would be to restore the subnormal condition at the time of the invasion of these infective germs, and prevent thereby the absorption of the toxins generated from these micro-organisms.

3. Watch for possible complications. While it is true that we can limit by local treatment the spread of active infective processes, on the other hand, when the body is weakened from anæmia, or from other depressing influences, this infection will spread in spite of the most vigorous local treatment.

Rest must be enjoined, more so in children with this disease than in most other diseases. We must aim to have the most perfect physiological repose. In this way we have the longest interval between the systoles and we keep down the blood pressure.

Prophylactic Treatment.—In trying to prevent rheumatism the hygiene of the skin requires careful attention. The body should be properly protected, due allowance being made for sudden changes in the weather. Too much clothing means overheating. Perspiration induced thereby invites this disease when the surface is suddenly chilled. Overheated apartments render children peculiarly susceptible to this disease. Proper ventilation, without incurring any draught, is urgently demanded. Cool or tepid bathing or sponging has a very good effect on the skin. Unnecessary and useless *hardening of children*, by exposing them to cold baths in cold rooms, without proper protection, will certainly invite this disease.

Dietetic Treatment.—Milk and milk foods; cereals and fruits, especially acid fruits; broths and all soups made from meat are indicated. For thirst, buttermilk, and all fermented milks, seltzer and milk, alkaline waters, lithia, apollinaris, white rock, lemonade, and orangeade.

Medicinal Treatment.—The alkaline treatment known as Fuller's method has been abandoned many years ago. The first thing to do is to cleanse the gastro-intestinal tract. A wineglassful or more, depending on the age of the child, of citrate of magnesia, repeated every two hours, until its effect is produced. Rhubarb and soda, 5 to 10-grain doses, or calomel, is valuable. Salicylate of soda, 3 grains every three hours, for a child 3 years old. Older children in proportion. This treatment should be continued two or three days, if the drug is well borne:—

℞ Natr. salicylat.	1 drachm
Elix. lactopeptin	2 ounces

M. Sig.: One drachm every three hours may be given.

Salol or salophen, in doses of 2 to 5 grains, is indicated. Aspirin is a valuable remedy in doses of 3 to 10 grains given every three hours. Cotton saturated with the oil of wintergreen applied over the affected joints, the whole covered with oil silk, is recommended.

Fever.—Fever requires the same treatment in this disease as in all others. Cold sponging of the surface will do good.

Restorative Treatment.—The profound anæmia caused by this disease is an indication for early restorative treatment. We should therefore aid nutrition by giving cream, butter, and, if tolerated, codliver-oil, with or without malt. Iron and iodide of sodium are good restoratives. Fellows' syrup of the hypophosphites may be tried. The application of leeches, blisters, or sinapisms sometimes does good. Ice-bags applied over inflamed joints will reduce swelling, remove heat, and have a very soothing effect.

An ice-bag applied over the heart if endocarditis complicates has served me quite well in some cases. For the management of heart complications, see chapter on "Heart Diseases."

It is vital to stimulate the action of the kidneys. For this reason I have previously mentioned the alkaline mineral waters. If a diuretic is indicated none is better than Basham's mixture. See formula in chapter on "Scarlet Fever," page 667.

The following ointment is useful applied on gauze to the affected joint:—

℞ Methyl salicylate	1 part
Vaseline	10 parts

Mix.

Apply morning and evening.

Warm Bathing.—By adding sulphur in the form of kalium sulphuret, about 1 ounce to an infant's bath-tub of water, and bathing the affected joints at a temperature of 95° to 100° F., is sometimes very grateful and well borne. It is not advisable to make sudden changes in the local treatment. If ice-bags have been used and are well borne, they should be continued. Sulphur baths, so also pine-needle baths, are very grateful in the evening, and sometimes promote sleep. When pains are very severe, full doses of codeine or chloralamid may be given. It is seldom that so much truth is contained in a single sentence as in the following from Cheadle: "The various manifestations of rheumatism massed together in the case of adults tend to become isolated in the case of children, so that the whole phenomena are distributed over years instead of weeks or months, and the history of a rheumatism may be the history of a whole childhood."

Muscular Rheumatism (Myalgia).

This painful condition is rarely seen in children. It is characterized by pain when the muscles affected are brought into play. When the disease affects the muscles of the neck it is called acute torticollis. When the intercostal muscles are affected it is called pleurodynia. When the lumbar muscles are affected it is called lumbago. Peculiar contractions of the muscles frequently follow persistent muscular rheumatism and sometimes cause permanent deformity (see chapter on "Torticollis"). Infants so affected usually cry when the group of muscles involved are moved. There is no fever present.

R. K., 16 years old, was attacked with a severe tonsillitis. The cervical glands were enlarged and tender on palpation. Creosote inhalations and unguentum Credé rubbed into the glands of the neck relieved this condition. Two days later after going out into the street she had violent muscular pains involving the back, groin, and muscles of the thigh. It was a distinct lumbago and a general myalgia. There was also a painful sciatica. With the aid of massage and the internal administration of 5 grains (0.3) salophen every four hours these pains gradually subsided. After these pains left there were pains involving the intercostal muscles, so that we had a lumbago followed by pleurodynia. Rest in bed, warmth, and massage relieved this condition permanently.

Treatment.—Local treatment consisting of massage aided by gentle faradic electricity is very useful. Warm, moist fomentations, such as flaxseed meal poultices, are very soothing and seem to do good. The internal administration of salicylate of soda has not seemed to benefit my cases. Codeine in $^1/_{10}$ to $^1/_{15}$-grain doses, repeated every two or three hours, can be given until the pain ceases. In some cases chloral hydrate combined with bromide of sodium will afford relief. Rubbing the affected muscles with ol. hyoscyamus seems to relieve.

TORTICOLLIS (WRY-NECK).

This condition is caused by the spasm of one sterno-cleido-mastoid muscle. Sometimes there may be a spasm of the posterior cervical muscle, including the trapezius.

Etiology.—Congenital torticollis is a rare condition. When it is present it is due, according to Whitman, to a constrained condition in utero.

More common than the congenital condition is the acquired torticollis. The following is Whitman's classification:—

1. The acute. 2. The chronic.

Acute torticollis (traumatic torticollis) may be divided into three classes:—

(a) "Stiff neck," due to "cold" or to rheumatism.

(b) Distortion caused by strain or other injuries.

(c) Distortion due to irritation of the peripheral nerves as following "sore throat," or secondary, to enlarged or suppurating cervical glands, and the like ("reflex torticollis").

The ordinary stiff-neck is of but slight importance. The traumatic wry-neck is efficiently treated by support. Reflex torticollis is by far the most important of the forms of acute torticollis, and it is the usual cause of persistent distortion.

Chronic Torticollis.—From the clinical standpoint, both the congenital and the reflex torticollis, after the acute stage has passed, are forms of chronic torticollis; the class includes also those forms in which the onset has not been accompanied by pain.

Rachitic torticollis, usually a postural or compensatory distortion caused by deformity of the spine.

Ocular torticollis, caused by defective eyesight.

Psychical torticollis, a functional or hysterical deformity.

Spasmodic torticollis, a convulsive *tic*—rather a form of nervous disease than a simple deformity.

Any irritation of the spinal accessory nerve or its branches may bring on this spasm. Whitman[1] gives the following statistics of 264 cases extending over nineteen years, torticollis from Pott's disease not being included: Males, 109; females, 155; congenital, 32; under 2 years, 33; from 2 to 10 years, 153; over 10 years, 46; acute (less than two months' duration), 77; chronic, 60, of which number 22 had lasted over two years or longer.

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[1] Report for Hospital of Ruptured and Crippled, New York.

Holt believes that an enlarged cervical lymph gland irritating the spinal accessory nerve can bring on this spasm. He also mentions malaria as a cause. I have observed similar conditions. In several of my cases the spasm was present when malarial infection existed, and subsided when quinine was given. Torticollis has also been observed by me after the sudden chilling of the body.

Symptoms.—The head is drawn to the affected side. If the trapezius is affected there is slight rotation of the head, but if the trapezius is not affected the head is rotated toward the healthy side.

A child 6 years old was taken on an open car. She was in a healthy condition, appetite good, bowels regular, apparently nothing wrong. She complained of being cold and on the following day had a wry-neck. Salicylate of soda, in 5-grain doses three times a day, and massage of the sterno-cleido-mastoid with spirits of camphor seemed to relieve the pain. The best result was obtained by the use of a mild faradic current. The condition lasted about nine days. The child was discharged cured.

The above case illustrates the form commonly described as rheumatism or "rheumatic torticollis."

Treatment.—*Medicinal and Local:* Early treatment means success. Delayed treatment means disappointment in most instances. When specific causes exist, such as malaria or rheumatism, they should be treated by specific remedies. In every case warmth, as flaxseed poulticing and massage, will do good. Sometimes the application of iodine over the affected muscles will do good.

Surgical Treatment.—Lorenz describes the fine results attained by subcutaneous intentional rupture of the sterno-cleido-mastoid muscle to cure obstinate wry-neck in children. The subject lies with a hard cushion under the shoulders, the head and neck unsupported. The shoulder is drawn down at the same time and it is thus possible to tear the muscle by gradual dehiscence, followed by over-correction. Parents accept this operation much more readily than when the knife is used, and the dehiscent fibers heal under the intact skin with little if any cicatricial formation. The cure has been ideal and permanent in all his cases.

PURPURA.

Hæmorrhages into the skin or mucous membrane are designated as purpura. When small they are called petechial; when large they are called ecchymoses. Purpura is frequently associated with the infectious diseases.

Martha B., 7 years old, was brought to the Willard Parker Hospital August 31, 1903. She had been ill two days before admission. The diagnosis of nasal diphtheria was made. On admission the pulse was 158. Two days later it dropped to 90, and on the third day the pulse-rate sank from 96 to 66. A general purpura was noticeable. There were bluish discolorations of the skin visible on the extremities. Dr. Burckhalter, the resident physician, called my attention to a hæmaturia. The case ended fatally.

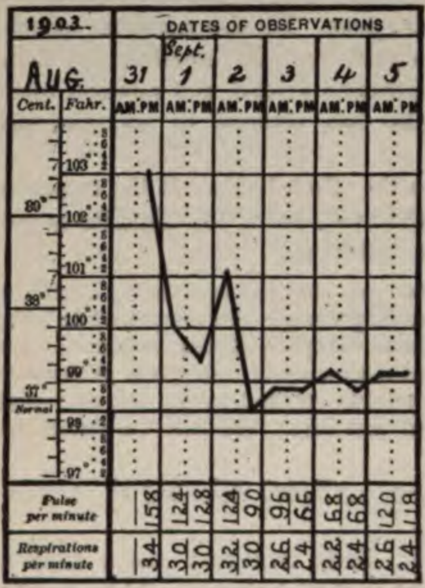

Fig. 234.—Malignant Purpura Complicating Nasal Diphtheria. General sepsis. Toxic Nephritis, meningitis, myocarditis. Note pulse. Fatal. (Original.)

PURPURA HÆMORRHAGICA (MORBUS MACULOSUS WERLHOFII.)

This is the most severe form of purpura. The lesions are a series of hæmorrhages confined to the mucous membrane and skin. On the skin purpuric spots are seen which denote hæmorrhages. These hæmorrhages are seen in the lower and upper extremities; also on the face and abdomen. The conjunctival mucous membrane shows ecchymotic areas. The gums bleed easily and there are hæmorrhagic areas on the soft and hard palate. Hæmaturia and hæmoptysis are sometimes seen.

Diagnosis.—The only disease that might be taken for purpura is scurvy, but the general history of the case associated with malnutrition will clear up any doubt.

Treatment.—Rest, iron, small doses of ergot and hydrastis internally, lemons, oranges, and a nutritious diet. Aromatic sulphuric acid in 5-drop doses, several times a day, should be remembered.

PURPURA RHEUMATICA (PELIOSIS RHEUMATICA: SCHÖNLEIN'S DISEASE).

The association of hæmorrhages with affections of the joints characterizes this disease. It has frequently been noted that there is tenderness in the joints during the course of simple purpura. But the more pronounced form of fever, in conjunction with swellings and tenderness of the joints, *plus* the characteristic appearance of the subcutaneous hæmorrhages appearing in purpuric spots, differentiate peliosis from simple purpura.

Associated with this rheumatic affection we frequently have extravasations of blood and serous effusions into the joints, giving a decided fluctuating feeling. One very important point is the fact that cardiac lesions do not complicate this condition. Cases of this kind have frequently been reported, and Baginsky lays stress on the non-existence of heart lesions in this affection.

The following case came under my observation[1]:—

A child, George P., about 9 years old, was attacked with pains in his feet and cried when attempting to walk. He had had some very violent exercise during the four or five weeks preceding this attack by riding a bicycle as much as four and five hours daily. The mother stated to me that he had frequently complained of joint pains, but she attributed them to "growing." She noted, however, that after bicycle riding the boy's pain was much more intense. His general condition was otherwise healthy. The examination gave me the following status:—

A very well nourished boy: muscular and adipose tissues quite well developed, and very tall for his age. His weight was 84 pounds. The examination of the thorax showed both heart and lungs normal; no cough; heart sounds regular, strong; pulse, 96. The temperature was 100.2 in the rectum, and respiration 36. The tongue was slightly coated; appetite good; bowels always inclined to constipation; but recently since riding the bicycle, very much improved. Intellect free, and the boy is mentally well developed.

The examination of the joints showed severe tenderness and swelling in both knees and ankles; slight pain on palpating or rotating the hip joint. The most marked tenderness and swelling was found at the knee joints. The upper extremities—shoulder, elbow and wrist—were perfectly normal, as far as palpation and inspection could demonstrate. The eruption on the skin was of a purplish or bluish color, and looked like a distinct subcutaneous hæmorrhage. It was confined to the lower extremities, covering almost completely the inner portions of both thighs, the ankles, and more especially the calves of both legs. The spots were very irregular in outline, in some places confluent, resembling more particularly the eruption of morbilli.

The child was put to bed, the joints were rendered immobile by applying woolen roller bandages over them, and locally over each joint some salicylic collodion, 10 per cent., was applied with a camel's-hair brush.

The main point in the treatment which I laid stress upon was to have *absolute rest*, and it was for this reason that I put the child to bed, that I painted salicylic collodion, and that I put a roller (flannel) bandage on the legs and covered both limbs from the toes to the hip joint. Internally I gave ergotine, $^1/_{30}$ grain every four hours, besides 15 drops of tinct. ferri acet. æth. in water after each meal, three times a day. The spots gradually changed from a deep bluish color to a brown; then after ten days to a light yellowish color, and after twenty-seven days they could scarcely be seen with the naked eye.

This case has a very interesting clinical history. The question that arose in my mind was: Did the violent exercise on the bicycle cause the inflammation of the joints and possibly also the subcutaneous hæmorrhages? On looking over the previous history of the child, I found that he had been well nourished, breast-fed until eleven months, and then weaned; commenced walking at 1 year, and talking at same age. Dentition began at seven months, and when eight months had two lower and two upper incisors; the child had seven teeth at eleven months, at time of weaning.

There is no sign of rickets, although there is a large belly, rather pendulous, and the previous history of constipation. The ribs are normal, the long bones well developed; spine and thorax as good as desired. I could obtain no data concerning time of closure of fontanels. There is no history of hæmophilia; no previous bleeding; no epistaxis; no hæmoptysis; both parents of the child living, and both healthy. The child has had measles, complicated with bronchitis, when 3 years old, lasting in all about one month. No disease previous to this; no summer complaint, and nothing since that time.

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[1] Pediatrics, vol. ix, No. 10, 1900.

There is no evidence of scurvy; teeth are well developed, perfectly normal; the gums are healthy. The mother had two other children—one now nursing and one 4 1/2 years old. She has had no miscarriages; no reason to suspect lues.

I believe the etiological factor in this case was the traumatic element, namely, the violent exercise causing both the hæmorrhages and the inflammatory affection of the joints.

HENOCH'S PURPURA.

Hæmorrhagic areas confined to the abdomen and lower extremities are sometimes seen. There is also vomiting and abdominal symptoms, such as diarrhœa (bloody stools) and colicky pains. There is marked distension of the abdomen and pains in the joints. This condition resembles that which has already been described in the article on "Purpura Rheumatica."

LITHÆMIA (LITHURIA).

Haig and Rachford have given us a very clear conception of this condition, which is simply an excess of uric (lithic) acid in the blood. Haig designates this condition as uricacidæmia. Other writers call it lithuria. Rachford calls this "leucomain poisoning."

Etiology.—When this condition is met with in children, we can usually look to the lithæmic ancestors for the origin of the disease. Imprudent diet, such as excess of proteids, may be a factor. Sedentary life and lack of proper metabolism invite this condition. The alloxuric bodies are excreted by the skin, kidneys, and intestinal canal. These bodies are removed by the kidney cells from the blood into the urine. When they are in excess they must, therefore, have been present in solution in the blood before their elimination.

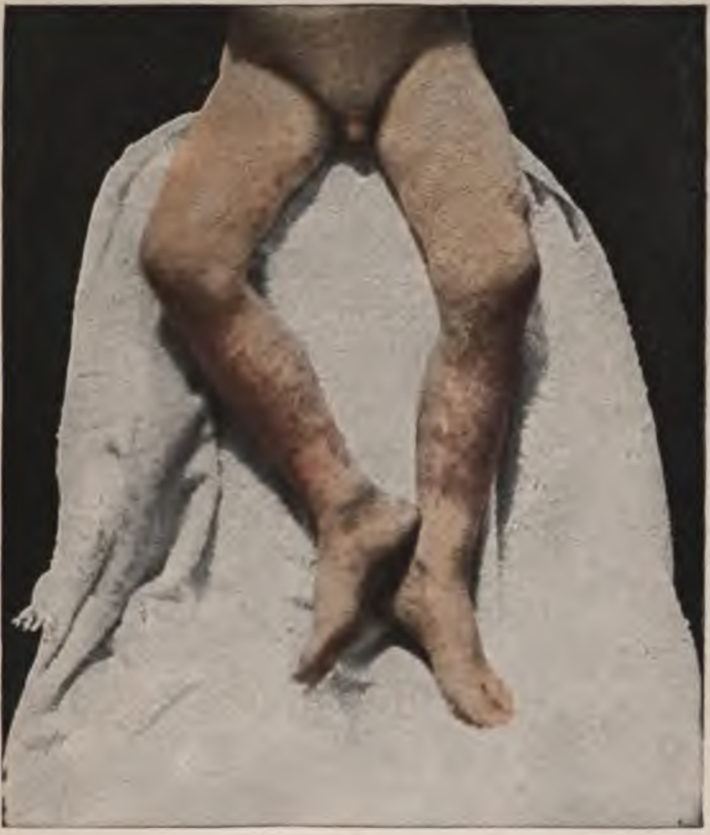
The presence of uric or lithic acid, xanthin, hypoxanthin, heteroxanthin, and paroxanthin are the factors causing this trouble. We are still in the dark concerning the manner in which these bodies act.

If the kidneys are diseased these bodies are retained and the skin is called upon to do the work which the kidneys fail to do. Thus it is that hot baths which promote diaphoresis eliminate through the skin, in addition to stimulating the action of the kidneys.

Symptoms.—The new-born lithæmic infant frequently eliminates an excess of urates during the first few days of life. In such infants crystals of uric acid may be precipitated into the tubules of the pyramids of the kidney. Jacobi says that these uric acid infarctions may subsequently be washed out of the tubules and serve as the nuclei of urinary calculi.

Nocturnal incontinence is frequently a symptom of lithæmia. True

PLATE XXI



Henoch's Purpura. Note ecchymotic spots on lower extremities. (Original.)

arthritic gout resulting from uratic deposits in the tissues about the joints is very rare in childhood.

Fever, crying while the child passes urine, scanty urine which usually deposits a reddish sand on the diaper, and irritation of the external genitals are the symptoms which appear at the time of urination. The urine is very acid and we speak of this condition as "a uric acid form of lithæmia." Sometimes there are gastro-enteric manifestations, such as vomiting, headache, gastric pain, convulsions, a sickening odor of the breath, and constipation. These gastric symptoms bear no relation to improper diet. They are usually met with in children who are carefully guarded as to the diet. Such children are extremely nervous and irritable. Eczema is a very common manifestation of this condition. Unless a proper understanding of this condition exists it will persist and be difficult to relieve.

The urine in lithæmia is high colored; the specific gravity increased. On standing, there is a sediment of red sand (urates). If the urine is examined immediately after a paroxysm then the poisonous xanthin bodies previously mentioned may be found present. Transient albuminuria is occasionally met with.

Treatment.—The diet is the most important part of the treatment. Cereals must be given; beef juice, soups, broths, and fruits. No alcoholics should be given; in fact, all rich and heavy articles of food must be excluded. Meat must be given sparingly. Salads and gravies are objectionable. Infants require massage. This passive form of exercise will stimulate the circulation. If children are old enough to exercise, then exercise should form an important part of the treatment.

Drug Treatment.—Calomel should always be given in the commencement of the treatment. We must aid in keeping the bowels loose during the whole course of treatment.

Salicylate of soda and salol are useful eliminatives. Phosphate of sodium and benzoate, especially if eczema exists, are valuable. Alkaline waters, such as white rock and apollinaris, may be given *ad libitum*. The Carlsbad waters have the same eliminative effect. Dilute hydrochloric acid or dilute phosphoric acid in 3 to 5-drop doses before meals is especially indicated when severe headache and gastric symptoms exist. Urotropin in 2-grain doses may be given in tablet form.

HÆMOPHILIA.

This is usually an inherited condition. It is characterized by a tendency to bleed, hence the term "bleeder" is applied to this class of cases. Whole families are found in which this tendency to bleed exists.

Pathology.—The walls of the blood-vessels show no alteration, either macroscopically or microscopically. "The swelling of the joints is due to hæmorrhages into the articulations and into the surrounding tissues. The tissues are blanched from loss of blood." The surface of the body shows petechiæ or bruised patches.

Symptoms.—The appearance of the child does not always disclose the tendency to bleed. It is only when an operation is performed or an injury exists that alarming and frequently fatal hæmorrhages are seen. Epistaxis is the most common symptom noted. Swelling of the joints resembling rheumatism is frequently seen. The bleeding takes place from the capillaries, most often an oozing which may continue for weeks. The subjects of hæmophilia are sensitive to cold.

In the chapter on "Syphilis" I have already described a case of bleeding in which the lesions of *syphilis* were present.

Annie G., 13 years old, was breast-fed in infancy. She had diphtheria when 1 year old. Had pertussis when 2 years old, which lasted nine weeks. Has had pneumonia twice. No history of rheumatism given and has had no other infectious disease.

History of Bleeding.—Has always been troubled with hæmorrhages. The nose bleeds at the slightest provocation. Blood spitting is quite common. The slightest irritation of the bowels with looseness is associated with blood in the stools. Large varicose veins are found over the legs. There are a number of scattered nævi. Not infrequently the veins of the legs bleed daily for a period of twenty or thirty days.

The Heart.—There is a loud systolic murmur heard in front and behind, and transmitted to the side. This endocarditis is a sequela to the attack of diphtheria. The child's weight when seen by me was 67 pounds. Stypticin seemed to do more good than ergot internally. Hydrastinine hydrochlorate, $^1/_6$ grain three times a day, seemed to check the bleeding during another attack. When last seen by me the child was developing fairly well.

Prognosis.—This depends on the frequency of the hæmorrhages and the child's general condition. In 152 cases reported by Grandidier more than one-half died before completing the seventh year, and only nineteen attained majority.[1]

Treatment.—All operations, no matter how slight, should be avoided if possible. Even the extraction of a tooth must be seriously considered, owing to the danger of bleeding.

The *diet* should consist principally of vegetables and fruits. When bleeding occurs, immediate treatment, consisting of ice and Monsell's solution, should be used locally. Internally, gallic acid and hydrastine, $^1/_8$ grain, repeated every three or four hours. If intestinal hæmorrhage exists, colon flushings of tepid water, temperature of 80° F., containing 1 *drachm* of alum to 1 pint of water, may be tried. Ice water is also recommended for the same purpose.

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[1] See article in "Starr's Text-book."

CHAPTER IV.

DISEASES OF THE GLANDS OR LYMPH NODES.

THE THYMUS GLAND.

THIS long lobulated gland is similar in structure to the salivary glands. It lies in the anterior mediastinum, immediately behind the manubrium of the sternum. The thymus reaches its full development during the second year, after which it gradually disappears. The function of the thymus is still a question, although it is believed to have a function similar to the spleen. Sudden death has frequently been attributed to an enlarged thymus. Tuberculosis involving the thymus gland is occasionally seen in current literature.

STATUS LYMPHATICUS.

This condition is found in rachitic children, and is of especial interest because of the enlarged glands at the angle of the jaw in addition to the adenoids in the vault of the pharynx, and enlargement of the lingual tonsil.

The cervical, bronchial, axillary, or the inguinal glands are enlarged. There is also a tendency to swelling of the parts. Enlarged lymph nodes at the angle of the jaw and hyperplasia of the connective tissue of the nose and pharynx are seen.

The thymus gland is very much swollen, and this is believed to be the cause of sudden death in many cases.

Escherich believes that the pathological condition of the thymus gland causes a form of acute intoxication resulting in cardiac syncope and paralysis. This condition must not be confounded with scrofulosis.

Escherich has reported a case in which laryngeal spasm occurred thirty times a day. In such cases the danger of asphyxia should be borne in mind. The condition is of importance because of the danger involved during the administration of an anæsthetic.

The following case was seen by me in consultation with Dr. A. W. Newfield during the summer of 1904:—

The infant was breast-fed, but did not seem to nurse well. The lymph nodes at the angle of the jaw, the groin, axilla, and various portions of the scalp could be plainly felt. The child had laryngeal spasms. Had had as many as twenty-five or thirty attacks of laryngismus stridulus. The adenoid tissue at the base of the tongue was enlarged. There was also a mass of adenoids in the posterior nares. The posterior pharyngeal wall was studded with fungous granulations. The infant had a very short, thick neck. The nurse in charge was always afraid the infant would die during these spasms. It was necessary to gavage to sustain life. By pumping some of the breast-milk and using cows' milk for alternate feedings we gradually strengthened the infant.

Codliver-oil inunctions were ordered to aid in the nutrition of the body.

When such a condition is found great care must be exercised so as not to lower the vitality of the patient, but rather to stimulate nutrition by giving arsenic in the form of Fowler's solution in addition to iodide of sodium.

ACUTE ADENITIS.

This inflammatory condition of the lymphatics is quite common. It is usually caused by an infection, or an abrasion of the skin, permitting an infection in or about the glands affected.

The cervical glands are most frequently affected.

Inflammatory conditions in the nose, throat, the mouth, or on the skin give rise to these swellings.

The axillary glands are frequently swollen, due to septic absorption following vaccination.

The glands of the thigh and the inguinal glands are commonly affected when there are irritations or inflammatory lesions involving the genitals, or the lower extremities.

Pathology.—The glands show swelling and infiltration with inflammatory products. The immediate tissues are usually involved. Very frequently the swollen glands resolve. At other times there is an excessive migration of white cells so that the glands break down and abscess results.

Symptoms.—The glands *per se* may show inflammatory symptoms, such as fever, tenderness, and swelling. It is wise to examine the adjacent parts to be sure that the glands are not a secondary inflammatory condition. For example, in diphtheria the neighboring glands are usually swollen. If the gland only is involved, we have no evidence of reddening or inflammation. When inflammation exists involving the neighboring tissues, a reddening of the skin takes place. Such cases usually have fluctuations, or soft areas can be made out. The glands are swollen, at times reaching the size of a hen's egg.

The diagnosis is very easily made.

The prognosis depends on the condition of the child at the time of infection. If tuberculosis exists, the prognosis is bad. The prognosis of acute adenitis in conjunction with acute exanthemata is usually good.

Treatment.—(a) *Abortive;* (b) *surgical.*

Abortive.—The inunction of Credé ointment has served me very well. A piece of the salve about the size of a bean should be well rubbed into the swollen gland. The rubbing should be continued at least ten minutes. Sometimes a leech applied to a gland will reduce the swelling. An ice-bag will reduce swelling and sometimes prevent suppuration. Belladonna ointment and ichthyol, 10 per cent., with lanoline is sometimes useful.

Surgical Treatment.—When fluctuation is felt, hot fomentations with flaxseed meal will be very grateful. An incision should be made, with aseptic detail, pus evacuated, and the wound packed with iodoform gauze.

Later restorative treatment, such as malt, iron, codliver-oil, or the syrup of the iodide of iron, should be given.

CHRONIC ADENITIS.

Not infrequently we meet with children who have swollen glands lasting months and years, in whom no evidence of tuberculosis or syphilis exists.

This is usually due to repeated attacks of inflammation following acute adenitis, or it is the result of chronic inflammation of the skin.

Pathology.—The glands show an increase in their cellular and connective tissue elements. They undergo a true hyperplasia.

Symptoms.—The symptoms consist in a swelling of the glands without inflammation or tenderness. In chronic adenitis the glands do not break down, hence suppuration is absent. In conjunction with chronic enlarged glands we find hyperplasia of the tonsils, so that we invariably have enlarged tonsils and adenoids in such conditions.

Diagnosis.—The diagnosis should be made after syphilis, tuberculosis, and other infections, such as diphtheria and scarlet fever, have been excluded, so that we can be sure no specific or infectious disease is the origin of the trouble.

The prognosis is usually very good.

Treatment.—The treatment consists in removing the cause. Middle ear inflammation, scalp disease, and pediculosis should be vigorously treated. Adenoids and diseased tonsils should be removed. Thus the treatment is narrowed down to removing the cause if possible and relying on restorative treatment, fresh air, and good nutrition.

TUBERCULAR ADENITIS.

This condition is due to an invasion of the tubercle bacillus, resulting in a tubercular manifestation of the glands. It was formerly believed to be "scrofulosis." The pharynx and tonsils seem to be the point of entrance, as the glands in the cervical region are usually affected.

Pathology.—The glands undergo a caseous degeneration which frequently results in abscess. At times we meet with tubercular lesions in various organs of the body. In the glands we note that they are studded with miliary tubercles and also find the tubercle bacillus therein.

Symptoms.—The glands enlarge in various parts of the body; most frequently the cervical glands are affected. It is usually a very slow process, extending over months; sometimes years. During this time, from the long continued inflammation, evidence of a continued illness is shown. When

materially aid in eliminating the diagnosis of syphilis. In Hodgkin's disease the glands do not suppurate. In simple chronic adenitis there is no suppuration.

Treatment.—Attention to hygienic details is of prime importance. The diet should consist of restorative foods in which proteids and fats abound. Restorative medication, such as iron, codliver-oil, iodide of sodium, and arsenic, and syrup of iodide of iron are the most useful drugs to be considered.

Read also the treatment outlined in the chapter on "Acute Miliary Tuberculosis."

The surgical treatment of tubercular adenitis should consist in the total removal of the suppurating glands, using aseptic precaution, rather than to rely on slow spontaneous evacuation of pus by Nature.

MUMPS (SPECIFIC PAROTITIS).

This is a specific febrile disease, characterized by inflammation of the salivary glands.

Etiology.—This disease is prevalent all over the world, occurring usually in the form of local epidemics. It is more marked during the cold and wet seasons than in the summer. The disease is disseminated from patient to patient by infectious material. Children between 10 and 15 years of age suffer most. Boys are more liable to be attacked than girls. Infantile parotitis is frequently met with. The nursing infant is not exempt from this condition.

The period of incubation, counting from the exposure to infection and the appearance of the disease, varies from fourteen to twenty-five days. It is usually about three weeks.

Pathology.—The disease is most likely due to an infection by a microorganism. The salivary glands are probably the seat of invasion.

Symptoms and Diagnosis.—The disease is preceded by fever lasting two or three days. The temperature may reach 104° F., although the usual temperature is about 101° F. The fever may be so pronounced that delirium accompanies the same. The most pronounced symptom is pain and tenderness in one parotid gland. The gland becomes swollen. The swelling occupies the space behind the angle of the jaw and below the ear, spreading forward on the cheek, and downward along the neck. The edge is ill defined, and the swelling itself is doughy to the touch.

Goodhart has reported cases in which the swelling was severe and the patient breathed with his mouth open. In such instances the tongue is dry and brown, but no serious import should be given thereto.

The swelling is confined to that portion of the neck between the jaw and the sterno-cleido-mastoid muscle. The center of the swelling is immediately under the lobe of the ear.

The swelling becomes so extreme and the pain so acute that the patient can hardly do more than separate the upper and lower jaw. The submaxillary gland on the same side becomes affected within a day or two and there is a large swelling below the jaw. Soon afterward the opposite parotid and submaxillary glands may also become involved. Goodhart states that a swelling of the cervical lymphatic glands may be the only local signs of mumps.

There is usually a general malaise. The swelling lasts four or five days and then subsides. Suppuration never results. The amount of saliva secreted is not altered. It may be excessive or on the other hand diminished.

Differential Diagnosis.—The glandular swelling in mumps has frequently been mistaken for diphtheria. In the latter disease the parotid glands are not affected. The patient rarely encounters difficulty in opening the mouth, even when the cervical lymph glands are enlarged.

The differential diagnosis between mumps and diphtheria must be made by a careful inspection of the fauces and tonsils and noting the absence or presence of membrane.

There are other conditions which may be accompanied by parotitis. In enteric and other fevers in various disorders of the abdominal cavity, one or both parotids may be inflamed. In these conditions, however, suppuration of the parotid gland may ensue.

Prognosis.—This is almost always favorable. Goodal and Washbourn state that during ten years in England and Wales there were but eighty deaths registered among the entire population. *These authors suspect diphtheria as the cause of most of these deaths, reported as mumps.*

Complications.—The *most disagreeable complication is orchitis.* This usually commences when the disease has progressed several weeks. It is accompanied by fever, sometimes chills. The body of the testicle and not the epidermis is involved. As a rule ice-bags or leeches aided by rest will relieve this condition. The attack usually lasts several days, but may be prolonged several weeks.

Treatment.—*Local:* Hot fomentations, consisting of ground flaxseed meal to which a few drops of laudanum have been added, are very grateful and well borne. They are to be applied between two thicknesses of cheesecloth. These poultices should be renewed at intervals of one-half hour. Among the newer local remedies, antiphlogistine, warmed and applied in the form of a salve, has been advocated.

The occasional application of a leech at the site of the swollen parotid will be found advantageous in some instances.

An ice-bag can sometimes be used to advantage. The local application of tincture of iodine can be recommended.

The inunction of:—

℞ Unguentum belladonna	6 drachms
Unguentum hydrarg. ciner	3 drachms

M. Ft. ungt.

To be rubbed in swollen glands every three or four hours, may be tried.

Another drug which is quite serviceable is ichthyol, to be applied several times a day, in the following manner:—

℞ Ammonium sulpho. ichthyol	2 drachms
Lanoline	1 ounce

M. Ft. unguentum.

To be thoroughly rubbed in swollen glands.

The local application of a 5 per cent. iodoform collodion painted over the inflamed region, several times a day, or a 10 per cent. salicylic collodion applied several times a day is at times beneficial.

The inunction of a 15 per cent. iodide of potassium ointment will be indicated if there is a suspicion of syphilis in the case.

Constitutional Treatment.—Rarely do we require internal medication in this disease. If, however, there is high fever, sponging the surface of the body or cold packs are indicated. The internal administration of a mild laxative, such as citrate of magnesia, is grateful and beneficial.

Five-grain tablets of rhubarb and magnesia will be required if constipation exists.

Owing to the infectious nature of this disease, the first rule should be to isolate. The isolation should be thorough and continued at least ten days from the beginning of the illness.

CHAPTER V.

DISEASES OF THE DUCTLESS GLANDS.

CRETINISM (MYXŒDEMATOUS IDIOCY—MYXŒDEMA).

CRETINISM is a form of idiocy associated with pachydermatous cachexia.

Etiology.—In my own cases psychical disturbances in the mother seemed to result in cretinism. Worriment and fright seemed to have some etiological relationship to the development of myxœdematous idiocy.

In two cases of mine the mother suffered with mental depression, constant worry, and hysterical symptoms during pregnancy.

Pathology.—We are indebted to Fletcher Beach for a series of careful post-mortem investigations which have thrown considerable light on the nature of this disease. We know that cretinism is due to the absence of the internal secretion of the thyroid gland. In some instances the gland is congenitally absent. This condition also results when the thyroid gland is removed by surgical means. It is safe, therefore, to assume that the loss of the function of the thyroid gland causes cretinism.

Holt believes that cretinism is in some instances associated with goiter. This disease occurs sporadically in our country.

Symptoms.—The characteristic manifestations are very apparent during the first year of a child's life. Sometimes distinct evidences of cretinism can be seen as early as the third month after birth. The child is short in stature and light in weight compared to the normal infant. The extremities, particularly the fingers, are short and thick. The lips are thick. The tongue is broad and thick, and constantly protrudes from the mouth. The fontanel is late in closing. The nose is broad, flat, and upturned. The nostrils are wide open. The hair is coarse and straight (straw-like). Dentition is delayed, and when the teeth do appear they are very poorly formed. The skin of the entire body is thick and dry, but does not pit on pressure.

The infant is stupid, and it is very noticeable that we are dealing with *deficient mental development.*

In the supra-clavicular regions there are regularly formed pads of fatty tissue, so that the neck is short and thick (Tuttle). The thyroid gland cannot be felt unless it contains a tumor. The abdomen is large and prominent and an umbilical hernia is frequently present.

Constipation of a very obstinate character is usually met with and persists for a long time. The temperature is subnormal. The thyroid gland

SPORADIC CRETINISM.

Fig. 236.—Child. Age 2 years, 2 months. (Original.)

Fig. 237.—Same child. Seven months after continued thyroid treatment. (Original.)

Fig. 238.-Same child. Age 3 years, 9 months. One year and seven months after continued thyroid treatment. (Original.)

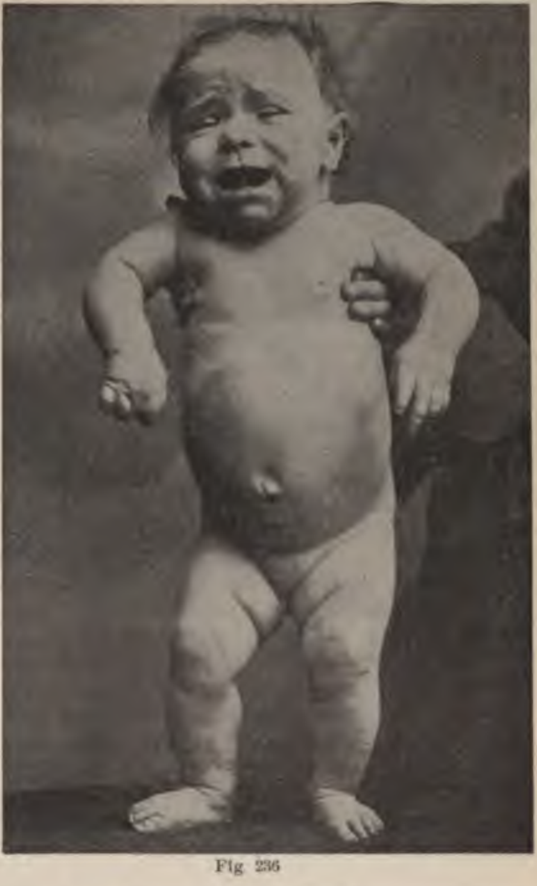

Fig. 236

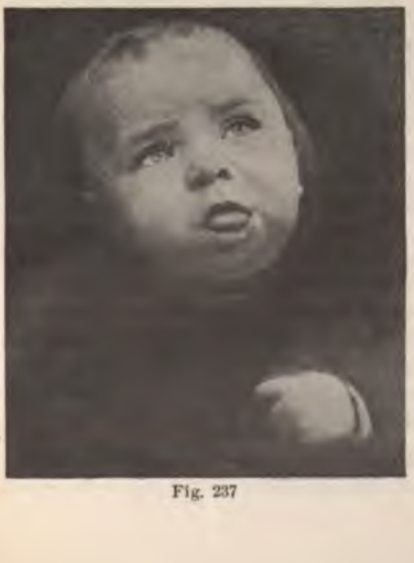

Fig. 237

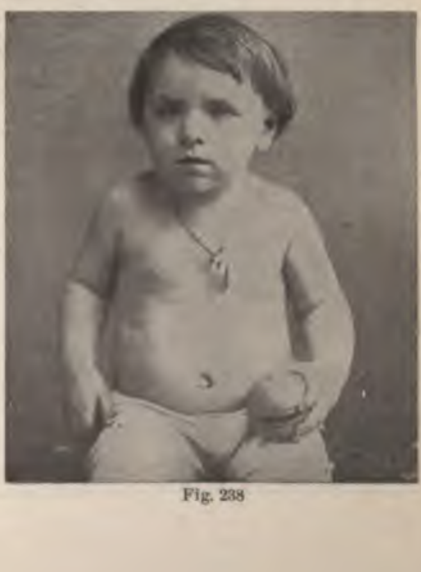

Fig. 238

is absent or cannot be felt. In palpating the thyroid region we can feel the trachea. In some cases there is a hypertrophied hypothenar eminence on the palms of the hands. The face in all cases has the prognathous expression (Koplik).

Diagnosis.—The value of an early diagnosis in this condition is more important than in any other disease with which we are brought in contact. The diagnosis can usually be confirmed after a short period of thyroid treatment. The specific results of treatment are more apparent in this condition than in any other infantile derangement with which we are confronted.

CASE I.—Frances P.[1] was referred to me by Dr. L. F. Haas. She was the seventh child of this family. All the other children were perfectly normal. The labor was normal. The child was born before the doctor arrived.

Family History.—The father is healthy. The mother is strong and healthy. During the pregnancy the mother constantly cried on account of family trouble. Her husband was out of work. The mother frequently had hysterics. Similar psychical disturbances were never present while pregnant with the six other children, who are all strong and healthy.

History Given by the Mother.—The mother noticed that the child had short limbs. That she was not bright mentally. That when $1\frac{1}{2}$ years old she could neither walk, talk, nor support her head. The tongue was very thick and protruded almost constantly while awake, as well as when asleep. The hair did not grow. The nose was short and flattened. The skin was yellowish and dry. The child had a jaundiced appearance. Constipation since birth. The bowels were moved with difficulty. The infant was breast-fed until it was fifteen months old. Up to this time there was no sign of dentition. She was taken to the Babies' Hospital, which necessitated her being weaned from the breast. She remained in the hospital about two weeks. When sixteen months old, one month *after thyroid treatment* was commenced, the first tooth appeared. The child was successfully vaccinated at the end of the first year.

During its first year and up to the time that it was taken to the hospital, it did not suffer with any infectious disease.

My first examination was on December 8, 1902. The child at that time was 2 years, 2 months old. The following conditions were found:—

The child can neither walk nor talk. The tongue is very thick and protrudes constantly. The lips, the eyelids, and the skin of the face are thickened, coarse, and rough. The nose is short and flat. The skin has a yellowish jaundiced appearance. The fontanel is widely open both anteriorly and posteriorly. The face is broad and the eyes are set very wide apart. There is a marked depression on each side of the temporal bone. There is a marked frontal protuberance. The child had nine teeth when twenty-two months old. As previously stated the first tooth appeared one month after the thyroid treatment was commenced, or when the child was sixteen months old. The body is well developed—fat. There is no evidence of rachitis. The chest and spine show evidences of good nutrition. The length of the body was $50\frac{1}{2}$ centimeters, or about 20 inches. The secretions of the body were very torpid. Constipation of a very obstinate form was encountered. There were several fatty growths in the sterno-cleido-mastoid muscle.

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[1] Three cases of cretinism were presented by me at the Section of Pediatrics of the New York Academy of Medicine, February 11, 1904.

The child had a violent fear of water, so much so that the mother had difficulty in bathing her. The hair is very thick and straw-like. The thyroid gland cannot be felt.

The pulse was 90 and of a full bounding character. There was a subnormal temperature which was never higher than 98° F. in the rectum in the evening. Respiration was 16 while quiet and 24 while crying. The urine showed traces of indican, evidently due to the constipation. No albumin or sugar was found. Microscopically no uric acid crystals; no casts, and no bacteria were found.

When the treatment was first commenced, 1 grain of thyroid was given three times a day. This dose was rapidly increased so that after the first week the child took 2 1/2 grains three times a day. The heart was carefully watched and no disturbance noted from the quantity of thyroid given. In addition, 10 drops of pure codliver-oil was given three times a day. Cereals, milk, chicken soup, broths, and acid fruits, such as oranges, lemons, and cranberries, were ordered. Fresh air and bathing, with vigorous friction, concluded the hygienic treatment. Under this vigorous treatment the child developed very fast. The length of the body was 58 1/2 centimeters at the end of the first month of this treatment. The growth, therefore, in one month amounted to 8 centimeters or 3 1/8 inches. The obstinate constipation was improved and the bowels became regular. The teeth have appeared at regular intervals. The facial expression has changed. The child now commences to walk, as also to talk, she says "mamma" and "papa."

The fear of water and to be bathed is past. She no longer cries when she sees water. At the end of 1 year, the length of her body is 85 centimeters or 33 1/2 inches, so that she has grown in 1 year 34½ centimeters or 13½ inches.

The child is still taking thyroid and is progressing favorably.

TABLE No. 100.—*Length and Growth of Body.*

Age.	Length of Body.	Gain in Growth of Body.
2 yrs. and 2 mos.	50½ centimeters (19 15/16 inches)	
2 yrs. and 3 mos.	58½ centimeters (23 1/16 inches)	1 mo., 8 centimeters (3⅛ inches)
3 yrs. and 3 mos.	85 centimeters (33½ inches)	12 mos., 34½ centimeters (13½ inches)

CASE II.—Rosie H., born January 1, 1902, now over 2 years old, was first seen by me when she was eighteen months old.

Family History.—Father living, is somewhat dyspeptic. Has no specific disease. The mother is a very nervous woman, otherwise in good health. This is her first child. She has had one other pregnancy of eight months which was still-born, believed to have been an asphyxia neonatorum. No miscarriages. No lues.

Child's History.—She was breast-fed for seven months, later she received equal parts of milk and water. When first seen by me at the age of eighteen months, she was still fed on equal parts of milk and water. There has always been severe constipation, and streaks of blood have frequently been seen in the stool from severe tenesmus. The examination of the child at that time showed coarse, sparse hair, and a very rough skin. The tongue and the lips were very thick. The tongue always protruded from the mouth; breathing was difficult. There was constant snoring, and the mouth was always open. The thorax was decidedly rachitic; there was a funnel-shaped depression, and also a kyphosis and an umbilicated hernia. The child could neither stand nor talk. There was no evidence of teething. The appetite was poor. The temperature was subnormal, 98 2/5° in the rectum. The pulse was

100, small, and feeble. The heart sounds muffled. A hæmic murmur was plainly heard at the apex and also in the vessels of the neck. It was impossible to secure a specimen of urine for examination. A drop of blood was examined and showed a decreased number of red blood-corpuscles and a marked leucocytosis. The diagnosis made was *sporadic cretinism*. The circulation was poor and there was a slight œdema constantly present. The feet and hands were frequently cyanotic, and always felt cold. The anterior fontanel was widely open. Growth was stunted as the length of the body was only 55 centimeters. The naked weight when 1 ¹/₂ years old was 11 pounds 13 ounces. When first seen by me there was neither muscular nor bony development which could be considered normal. At eighteen months the child had had no teeth. At twenty-two months the first tooth appeared. The muscles of the body were limp and flabby. The child could not support her head nor was there good support to the spinal column. The patellar reflexes were but slightly present.

Treatment.—The treatment consisted in giving fresh, raw milk warmed to body temperature. In addition to the milk, steak juice, orange juice, potato flour, and the usual antiscorbutic remedies were ordered. Fresh albumin, using the raw white of egg, and vegetable proteids, such as pea soup and lentil soup, were very well assimilated.

The medicinal treatment consisted of two drugs. Thyroidine was given in doses of ¹/₂ grain three times a day, and gradually increased until 3 grains were given three times a day. The other drug was Fowler's solution given in 1 drop doses, increased to 3 drops three times a day. It is now about six months since the treatment was commenced. The child has grown in length from 55 centimeters to 69 centimeters and the weight has increased from 11 pounds 13 ounces to 17 pounds.

CASE III.—Rosie N. was first seen by me on June 28, 1902. She was then seventeen months old.

Family History.—Father is healthy. No family history of tuberculosis, syphilis, or any other taint. The mother is in good health and has never had any serious illness nor miscarriage. This was her first pregnancy. The mother's condition was good, there was no traumatism nor any psychic disturbance. The infant was born without the aid of instruments. It was a perfectly normal delivery. The mother menstruated while nursing the infant.

Personal History.—The infant was nursed about sixteen months. She did not seem to thrive since she was three months old. Severe constipation had always existed, and was present when I first saw her. She could neither stand, walk, nor talk. Backwardness in development was very apparent. Spasmus nutans was present. The fontanel was widely open. She showed no signs of intelligence. The hair was coarse and straight. The extremities were short. The growth stunted. She presented a squatty appearance. The skin was rough, thickened, and large eczematous patches covered the arms and legs. The child was sent to me by Dr. L. Weiss, who had her under his care for the relief of the eczema. The lips were thick. The tongue was thick and protruding. She had two lower incisors; no other evidence of dentition. The facial expression was senile and corresponded with that of a typical cretin. She was restless by day and suffered with insomnia by night. The urine was examined and contained no albumin nor sugar. Slight traces of indican were seen, microscopically nothing pathological. The blood examination showed four million six hundred and twenty thousand (4,620,000) red blood-corpuscles, and seven thousand two hundred (7200) white cells.

The percentage of hæmoglobin taken with Gower's instrument was about 40 per cent. As digestion was very poor I decided to syphon off the gastric contents two hours after a meal and to examine the same chemically.

SPORADIC CRETINISM.

Fig. 239.—Child. Age 1 year, 5 months. (Original.)

Fig. 240.—Same child. Age 2 years. (Original.)

Fig. 241.—Same child. Age 3 years, 5 months. (Original.)

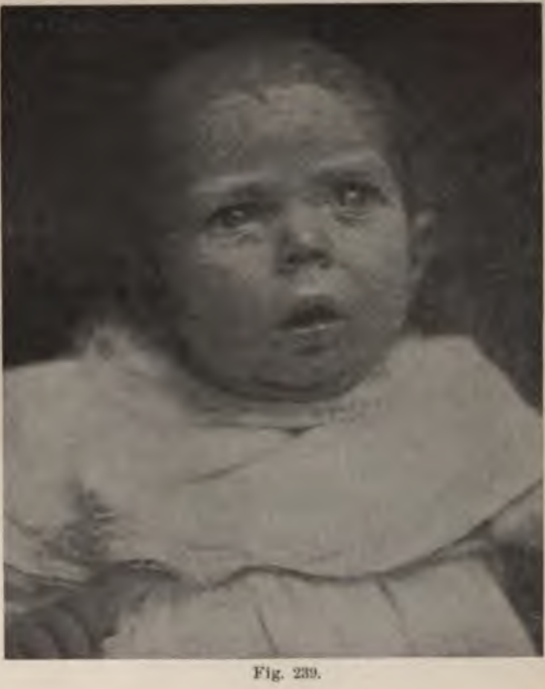

Fig. 239.

Fig. 240.

Fig. 241.

Feeding.—The feeding was barley water. About 5 cubic centimeters were syphoned off, which showed traces of peptones, starch, and sugar; HCl was absent by Gunzberg's test. I am indebted to Mr. Charles LaWall for his assistance in the chemical analyses of the gastric contents, made a number of times.

Equal parts of milk and barley water were fed every few hours. Thyroid treatment was commenced; $^1/_2$ grain of the desiccated powdered thyroids was ordered three times a day. The dose was gradually increased and the child now receives 3 grains three times a day. There was no cardiac disturbance from this dose.

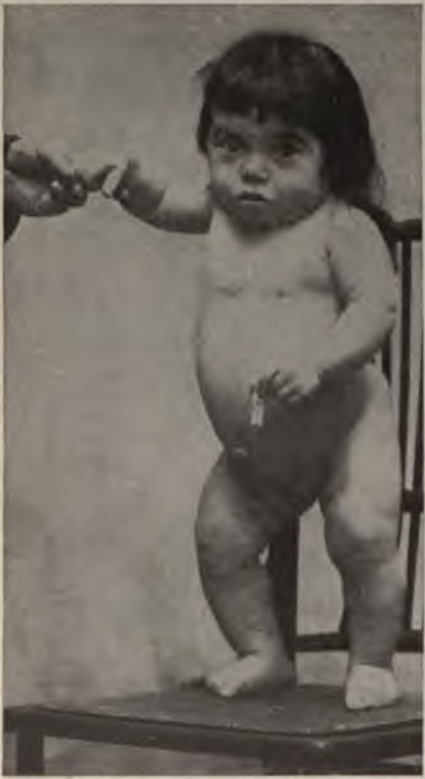

Fig. 242.—Cretinism. Age 7¼ years. Height 26½ inches. Front view.

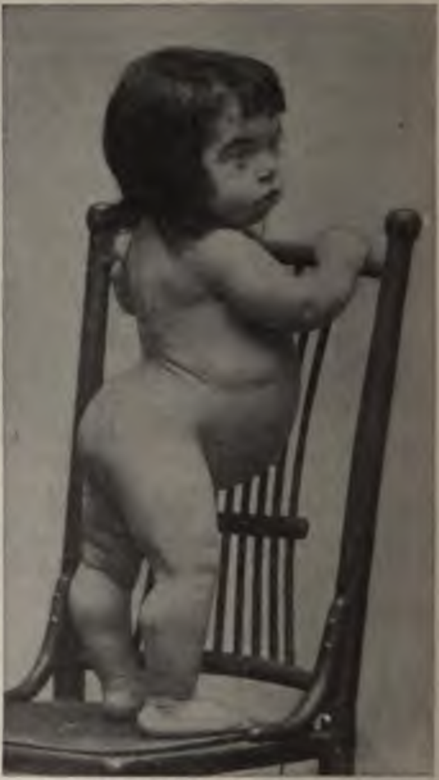

Fig. 243.—Cretinism. Age 7¼ years. Height 26½ inches. Back view.

Lemon juice, orange juice, raw albumin, and vegetable soups were ordered. The child's condition improved. The specific effect of the thyroid was very apparent.

Case IV.—Gussie S.,[1] 7 years and 3 months old when she came under my observation. She was born January, 1897. She is the oldest of four children. The other children are to all appearances healthy, as are also the parents.

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[1] I regard this case as the most complete type of cretinism that I have ever seen. The notes were kindly furnished by Dr. A. E. Isaacs, in whose practice the case occurred.

Family History.—The mother claims to have had a severe fright during her sixth month of pregnancy, and attributed the child's mental deficiency to this psychical disturbance. There is no history of any condition similar to this child's on either side of the family. Parents are natives of Russia. They are 13 years in this country, and do not know of any such disease in their native country. The parents are not related.

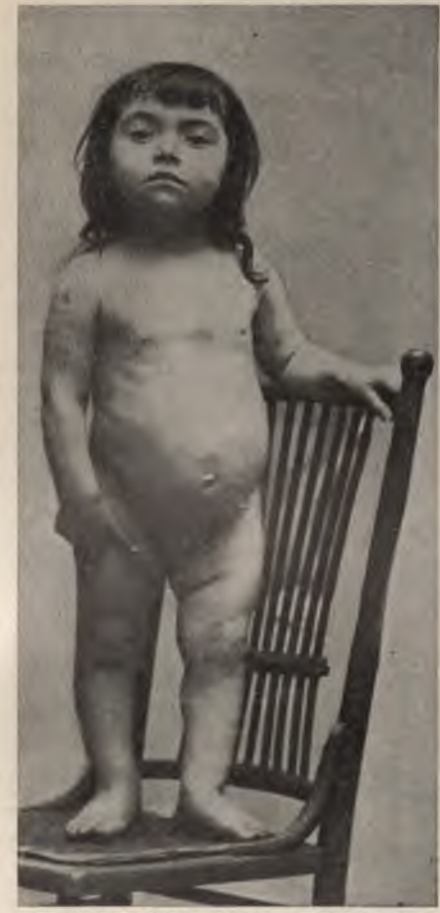

Fig. 244.—Cretinism. Same case. Age 8 years. Height 33¼ inches, gain 6¾ inches.

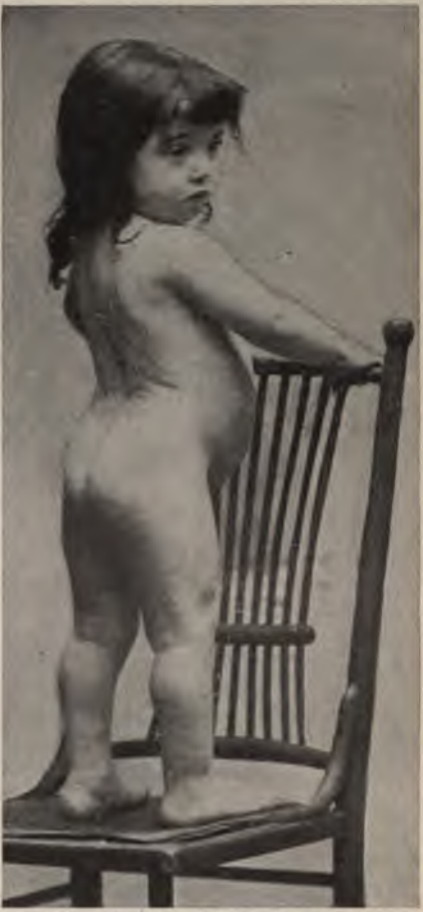

Fig. 245.—Cretinism. Same case. Age 8 years. Height, 33¼ inches, gain 6¾ inches. Back view.

Feeding.—The child was breast-fed for about two years. She did not receive any other food during this period. When the child was thirteen months old the mother's menstruation returned. The mother continued to nurse the child until the end of the second year, although she continued to menstruate every month.

Nothing unusual was noticed about this child until the end of her first year. She cried very little and slept a great deal. At about 1 year of age parents noticed that she differed from other children of the same age. No teeth appeared. She made no attempt to walk or stand. Never laughed or smiled, was always apathetic and took no interest in her surroundings. There was no appreciable growth in height from 1 to 7 years. The same dresses always fitted her. In her fifth year she was for a period of six months very cross and restless, but this disappeared as it came, without any known cause.

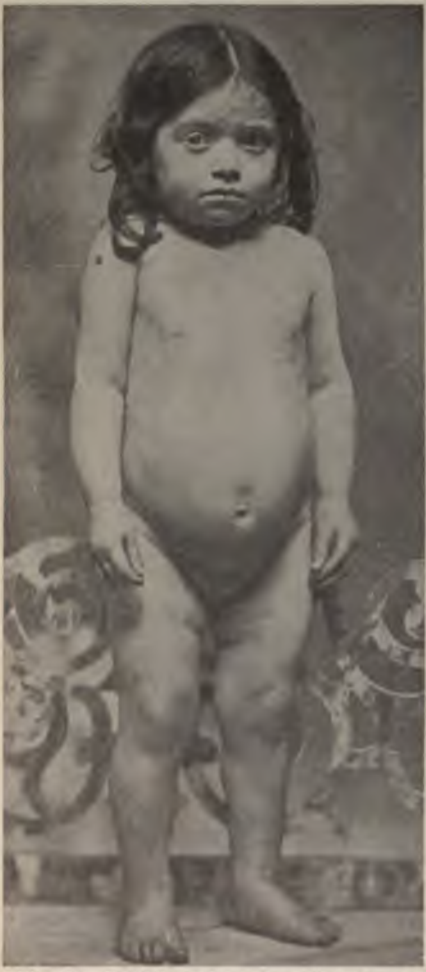

Fig. 246.—Cretinism. Same case. Age 9 years. Height 37¾ inches, gain 4½ inches. Front view.

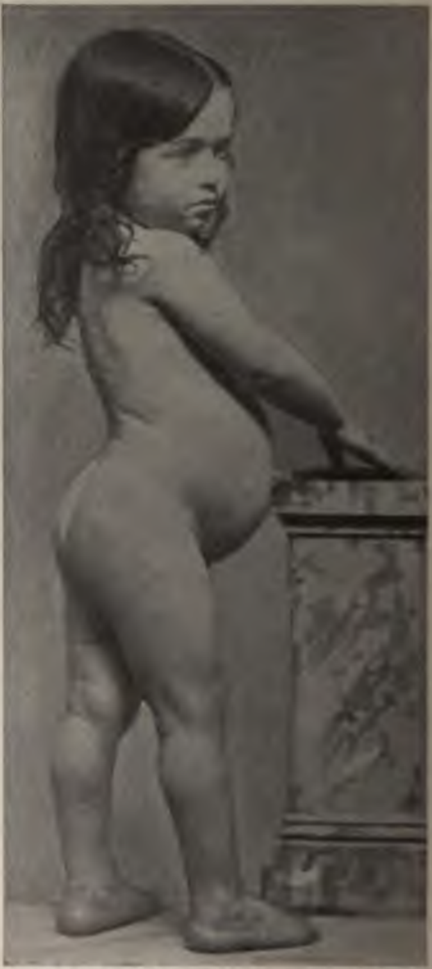

Fig. 247.—Cretinism. Same case. Age 9 years. Height 37¾ inches, gain 4½ inches. Back view.

She cut her *incisor teeth at 3 years of age* and the rest at 4 years. She has never had convulsions or any other sickness except measles when 4 years of age. She began to stand on her feet with assistance when 3 years old. She did not speak a word until 5 years old, from which time till I took charge of her she could say no more than "papa" and "mamma."

When she came under my observation, she was 26½ inches high. She weighed

$25\,^1/_2$ pounds and was quite stout in proportion to her height. Her head was large in proportion to her body. The lips were thick. The nose flat and depressed between the eyes. The neck was very short. No sign of enlarged thyroid, large blue eyes, teeth in fair condition, complexion dark, hair dry and of a rusty black color.

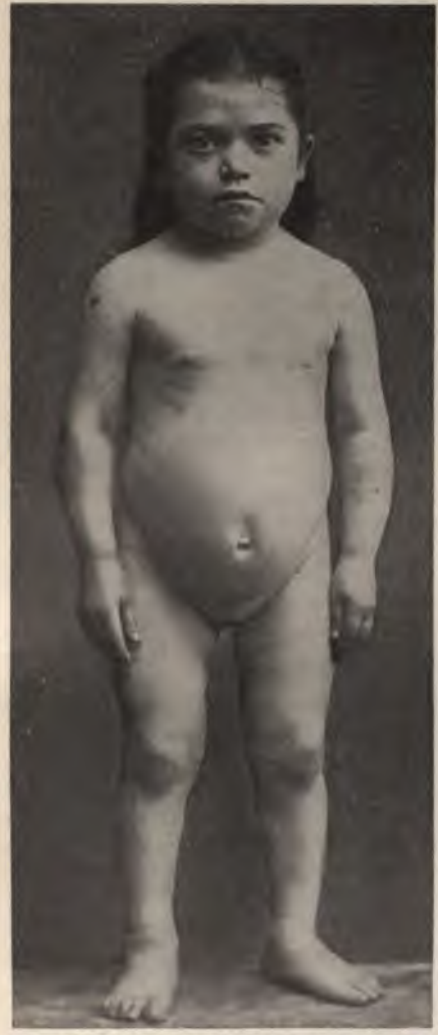

Fig. 248.—Cretinism. Same case. Age 11 years. Height 39¾ inches, gain 2 inches. Front view.

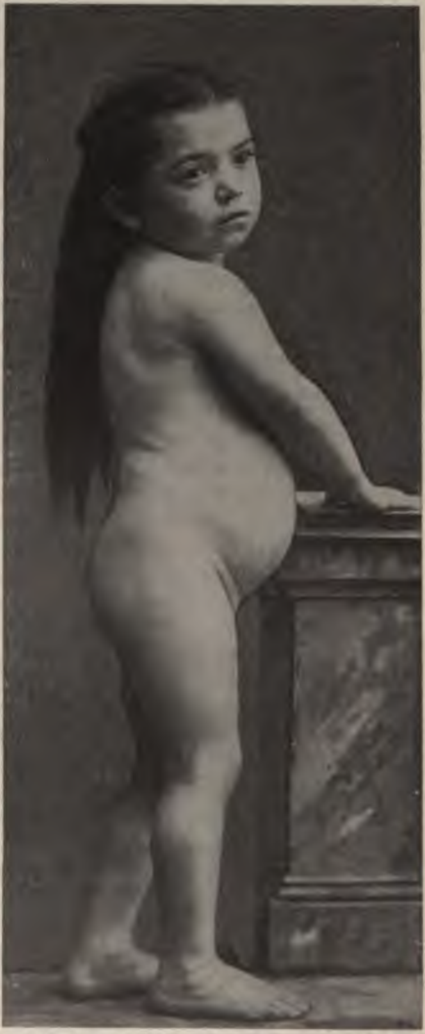

Fig. 249.—Cretinism. Same case. Age 11 years. Height 39¼ inches, gain 2 inches. Back view.

Hearing, sight, and smell apparently good. Voice not out of the ordinary. The extremities were short and thick, lower ones were bow-legged. The ends of the bones were large. The belly was large and its prominence exaggerated by a decided anterior curvature of the spine. Intelligence was almost *nil*, temperament very irritable, does not cry, but becomes very angry. She never asks for food, eats little and only what is given to her. The bowels were constipated, moving only once in two days. She never asks to pass stool or water. Had external hæmorrhoids, which bled occasionally. When awake was constantly sitting. Cannot walk alone and only a few steps when assisted. She slept well. Pulse was 96 and regular.

Has had no treatment for three years. Previous to this time parents had been all over with her and tried everything suggested, without avail.

On January 25, 1897, I put her on 3 grains, once a day, of desiccated thyroids (Parke, Davis & Co.). On February 18th dose was increased to 4 grains daily, but after a week the dose had to be reduced to 2 grains, as the pulse rose to 120 and the child became irritable. Otherwise, some improvement was already noted in her general condition; she could stand better and moved her bowels daily. After another week (March 6th) the dose was increased again to 3 grains daily and was continued so till I saw her on March 21st, when I found her pulse 144, strong and bounding. She had become considerably thinner, having lost $1\frac{1}{2}$ pounds in weight in spite of the fact that she had gained 2 inches in height. This gave her a much more natural appearance. She also had a more intelligent facial expression, talked more and decidedly better, walked a short distance without assistance, and ate better.

On account of the accelerated pulse and loss of flesh, I decreased the thyroids again to 2 grains daily. From this time on there was a gradual improvement in all the symptoms. By the middle of April she was running about the streets, playing with other children, and asked for her food. In May she began to tell when she wanted to move her bowels, gradually gained in intelligence, spoke more and articulated better. The dose of the thyroids was gradually increased until she was taking 5 grains daily (July), which she continued for more than a year and a half without any symptoms of intoxication.

I had the honor of presenting her before the Society[1] in 1898 after one year's treatment, when she had gained $6\frac{3}{4}$ inches in height. The privilege was accorded me again in 1899 when she had gained an additional $4\frac{1}{2}$ inches. The average growth of a normal child of her age is less than 2 inches a year. *She had gained over eleven (11) inches in two years.*

As interesting as this case is so far, the most significant and interesting part of it comes now. I lost track of the patient in January, 1899, and she took no medicine from that time until I saw her again in December, almost a year later. My notebook records the fact that there was no increase in height and that her general appearance was not good. Although I ordered the thyroid extract it was not given again until I saw the patient one-half year later, on June 1st, 1900, and again there was no increase in height or improvement in general condition. The patient's next visit was in February, 1901, when she reported that 5 grains of the thyroid had been given daily from June 1st to December 24th. Measurement showed a gain of 2 inches in height ($39\frac{1}{2}$). Her general appearance was much better and she had been going to school for a few weeks.

If any proof be necessary as to the efficacy of the thyroid principle in cretinism, or as to the thyroid gland and its secretion being essential to the proper physiological workings of the human body, the history of this case supplies it. Take the one symptom of stature. From 1 to 7 years of age, without the administration of thyroids, there was no increase. From 7 to 8 years, with thyroids, there was a growth of $6\frac{3}{4}$ inches. From 8 to 9 years, also with thyroids, there was a growth of $4\frac{1}{4}$ inches. From 9 to 10 years, without any thyroids, there was no growth. From

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[1] Eastern Medical Society, New York City.

10 1/2 to 11 years, with thyroids again, 2 inches were gained. All other manifestations of this cretinic condition underwent corresponding fluctuations with the administration of the extract, but changes in stature being the most evident, serve best to illustrate the progress of the case.

To contrast her previous with her present condition as well as to show her appearance during the period of her improvement no better means could be utilized than the accompanying photos. The first pair was taken in February, 1897, the second in 1898, the third in 1899, and the fourth in February, 1901.

She is now sufficiently intelligent to go to school. She plays as a child should and her general health is very good. She has yet the physical marks of her previous condition in the peculiar features, the short neck, and the spinal curvature with the abdominal prominence, though they have all improved, especially the spine and the abdomen. Her height is about 12 inches short of what it should be at her age, 11 years, but if the rapid rate of growth continues she will gain a good part of it.

September, 1901.—Has taken little medicine. Height about the same.

April 27, 1902.—Has taken medicine one and one-half months since last visit. Height, 41 1/4 inches; goes to school.

September 4, 1902.—Has taken 5 grains daily since April 27th. Looking and feeling well. Losing flesh, feels cold at night, hands tremble when taking things to mouth since six weeks. Pulse, 188. Height, 41 1/2 inches. Discontinued thyroids three weeks.

I saw case on December 20, 1902. No thyroids since last week. Patient is gaining flesh, shivering (trembling) stopped. Pulse, 72. Goes to school, has mastered her figures only (is almost 13 years old). Ordered 2 1/2 grains thyroid daily.

When last seen, April 20, 1904, the mother stated the girl had been going to school for the last two years. Very little mental progress has been made during this time. She reads an elementary primer and can remember figures. Has taken thyroid but four months out of the last sixteen months. Her height is 43 1/4 inches. She has gained in the last sixteen months about two inches. Her pulse-rate is 72.

Prognosis and Course.—The sooner treatment is instituted the better the result. When this condition is neglected, children become worse and worse until finally they are beyond medical aid.

It must be borne in mind that thyroid must be given for years if lasting results are to be obtained. Children will go backward at once if we discontinue our treatment, even though the same has been continued for some years. An interesting study is the continuous growth including mental development plainly seen in the illustrations of cases in this chapter.

Treatment.—The most important part of the treatment consists in administering from 1 to 5 grains of the dessiccated extract of thyroid. This replaces the active principle of the normal thyroid gland. I have used with very good success thyroidin, from 1/2 to 2 grains three times a day, with equally good result.

Great care should be taken to watch the pulse-rate while giving thyroid. The pulse will sometimes increase from twenty to forty beats after the administration of 1 or 2 grains of thyroid. The moment we find an exaggerated pulse-rate, it will be necessary to reduce the dose of thyroid at least one-half. A flabby, fat child will at once lose weight, and an important feature of successful treatment is an increase in height.

Thyroid Implantation.—Implantation of sheep's or lamb's thyroid (heterogeneous), or from the human being (homothyroid), has been advocated by some. In one case of mine, operated by Dr. Howard Lilienthal, the implantation of lamb's thyroid was tried. Several pieces were implanted in the peritoneal cavity. Some improvement was noted.

We must not, however, blindfold ourselves to the belief that when we supply the missing internal secretion, namely, thyroid, that we have fulfilled all indications.

The diet must be regulated and the child given a large portion of proteids—milk, meat or meat extracts, fresh beef blood or roast beef juice, orange juice, fresh eggs, and all cereals must be given as body builders. Fresh air and a general attention to the hygienic condition of the child are very important. Massage, gymnastics, and exercise should not be overlooked.

If the appetite is poor 1 to 2-minim doses of the tincture of nux vomica will do good. Butter and codliver-oil are valuable adjuncts.

EXOPHTHALMIC GOITER (HYPERTHYREA, BASEDOW'S DISEASE, GRAVES'S DISEASE).

This disease has occasionally been seen in children. It is supposed to be due to a hypersecretion of the thyroid gland. Sachs believes that heredity is a more important factor than excitement or fright. Epileptic and alcoholic parents certainly predispose to this condition in children.

Symptoms and Diagnosis.—There are three symptoms of importance which should be noted:—

1. The enlargement of the thyroid.
2. Palpitation of the heart (tachycardia).
3. Protrusion of the eyeballs (exophthalmus).

The blood tension is increased, hence hæmorrhages from the nose, stomach, or intestines are quite common. Disturbances of vision due to the exophthalmus are never described. The thyroid enlargement is usually bilateral. Muscular tremors are also noted. The diagnosis is easily made by recognizing the symptoms above described. There is a physiological hyperæmia of the thyroid which is entirely different from goiter.

Prognosis.—Cases seen by me have all assumed a chronic tendency. I have never known death to occur directly from this condition. When death occurred it was due to some complication.

Treatment.—Spartein sulphate, strophanthus, digitalis or belladonna combined with iodide of sodium may be tried. The galvanic current is strongly advised by some writers. Recently x-ray treatment has been used in conjunction with the above mentioned drugs. The danger of x-ray dermatitis should be remembered by those having little experience with light treatment.

The use of thyroid has been suggested, but it has failed to do good in my hands.

ACUTE THYROIDITIS.

Inflammatory conditions such as abscess have been described as a complication of the infectious diseases. The migration of streptococci or other pyogenic bacteria may give rise to suppurative inflammation. The treatment is surgical.

ABNORMALITY OF THE THYROID.

Syphilitic gummata and tuberculosis have been found in rare instances. Malignant disease involving the thyroid has been reported among infantile disorders.

DISEASES OF THE THYMUS GLAND.

In rare instances the thymus gland may persist until the twentieth year or even later in life. When such a condition exists mechanical pressure has caused dyspnœa of a serious nature. Asthma has been reported by some clinicians in which an enlarged thymus was found, hence the term "thymic asthma." Sudden death has occasionally been caused by an enlarged thymus. This has been especially noted in children with rickets. Abscesses have been reported in the thymus by Dubois. Syphilis and tuberculosis have rarely been found.

Reich says: "The absolute dullness of the thymus, as determined by light percussion, is irregularly triangular in outline, the base being made by the outline connecting the two sterno-clavicular articulations, the blunt apex situated at the level of the second rib or slightly below it, and the sides a little beyond the edges of the sternum. The larger half of this triangle of dullness usually falls to the left side. When the limits of dullness, as given above, vary by one or more centimeters, or obscure the pulmonary resonance between the upper line of cardiac dullness and the lower lateral limits of thymus dullness, an enlargement of the thymus is probable. The thymus dullness is present until the end of the fifth year, after which it is inconstant."

Diagnosis.—The diagnosis of diseases of the thymus gland is frequently impossible. An infiltration or swelling of the area surrounded by the thymus gives rise to symptoms of dyspnœa, from pressure upon the pneumogastric nerve. The same symptoms are also found when the thymus itself is enlarged. When the lymph glands in the anterior mediastinum are swollen, dullness on percussion is rare unless there is a cheesy infiltration of the lymph glands, according to Reich.

Treatment.—Symptomatic treatment only should be instituted. The iodide of sodium in very large doses may be tried.

DISEASES OF THE ADRENAL GLANDS.

Pathologists have frequently described hæmorrhages into the adrenal glands in the new-born infant. Diseases *per se*, excepting cancer, have not been described. There is still considerable to be learned concerning the physiology of these glands.

ADDISON'S DISEASE.

This rare condition is occasionally described. Literature records about twenty cases in all.

Symptoms.—The symptoms of the disease consist of a deep yellowish or bronzed pigmentation of the skin. It is found on the exposed parts of the body, such as the hands and head. The mucous membranes of the mouth and vagina are also pigmented. White areas of skin are scattered over the body. Vomiting, diarrhœa, and nervous symptoms are noted. Anæmia is usually very marked.

Diagnosis.—In the diagnosis of this condition it is necesary to exclude pigmentation of the skin due to metallic poisons, such as argyria, from the internal administration of nitrate of silver. Arsenic and lead have been reported as causative factors of bronzed skin.

Prognosis.—While most authors report the outcome as fatal, some few recoveries have been noted. In a case seen by me recovery took place after several years of treatment.

Treatment.—We have no specific treatment for this condition. Some authors advise the administration of the raw or cooked adrenal glands of the sheep. The dry extract in tablet form has been isolated and 1-grain doses of this extract may be given three times a day. When the gland itself is used, one-half to one gland may be given in twenty-four hours.

The value of hygienic and dietetic measures I regard as more important than medication.

PART IX.

DISEASES OF THE NERVOUS SYSTEM.

CHAPTER I.

FONTANEL.

THE posterior fontanel is usually closed at the end of the second month. The anterior fontanel normally closes between the sixteenth and twentieth months. If the fontanel is open at the end of the second year, then rickets or other abnormality may be considered. A fullness of the anterior fontanel and bulging of the same at the end of the second year is pathological. (See chapter on "Hydrocephalus.") Premature closure of the fontanel frequently occurs in microcephalus and also in congenital idiocy. This premature closing interferes with the proper growth and development of the brain.

Shape of the Head.—Peculiar shapes of the head are met with under perfectly normal conditions. An interesting study is the series of outline sketches of the head which show the modifications in form produced by labor and also the normal sketches of the head.

Circumference.—The average circumference of the head at birth in 446 full-term infants taken in about equal numbers from the Sloane Maternity Hospital and New York Infant Asylum, quoted by Holt, was as follows:—

Average circumference of the head,	231 males..	13.90 inches	(35.5 centimeters)
Average circumference of the head,	251 females	13.52 inches	(34.5 centimeters)
Total..........................	446 infants.	13.71 inches	(35.0 centimeters)

Auscultation of the Anterior Fontanel.—A bruit is occasionally heard over the anterior fontanel. (Plates 22, 23.) It is a blowing sound similar to that heard in the vessels of the neck during anæmia or in chlorotic girls. I have described this condition in the chapter on "Rachitis."

PERCUSSION OF THE SKULL.

MacEwen, in his treatise upon the pyogenic infective diseases of the brain and spinal cord, says: "When the lateral ventricles are distended with serous fluid, as would be occasioned by cerebral tumors pressing on the fourth ventricle, or by occlusion of the veins of Galen or otherwise, the percussion note is markedly altered, the resonance being greatly increased.

OUTLINE SKETCHES OF THE HEAD, SHOWING THE VARIOUS DIAMETERS.

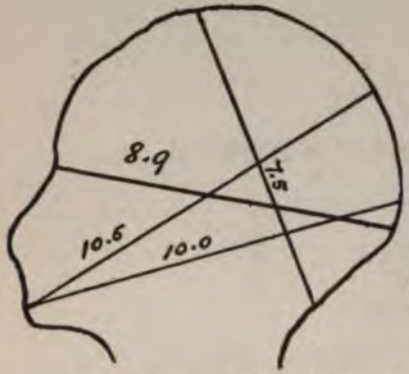

Fig. 250.—Sagittal Section of Normal Head of Seven and One-half Months' Fœtus, Half Natural Size. (After Ballantyne.)

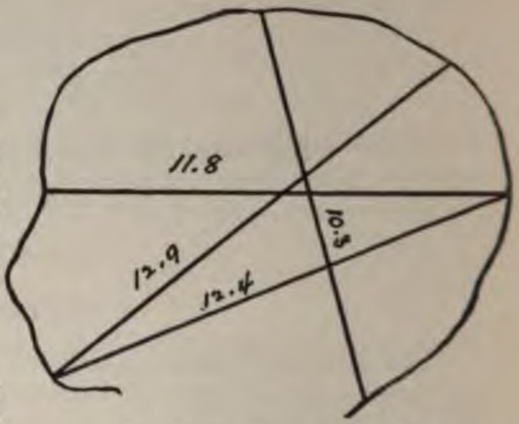

Fig. 252.—Sagittal Section of Normal Head, Half Natural Size. (After Budin.)

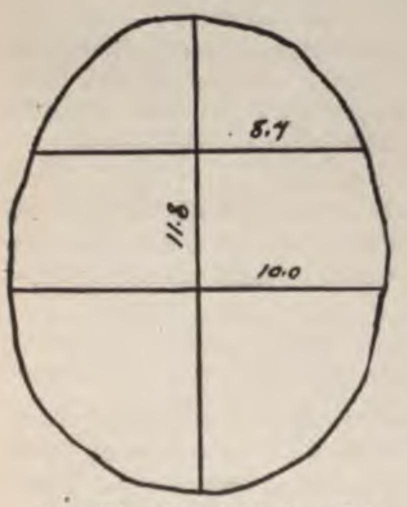

Fig. 251.—Normal Head as Seen from Above, Half Natural Size. (After Budin.)

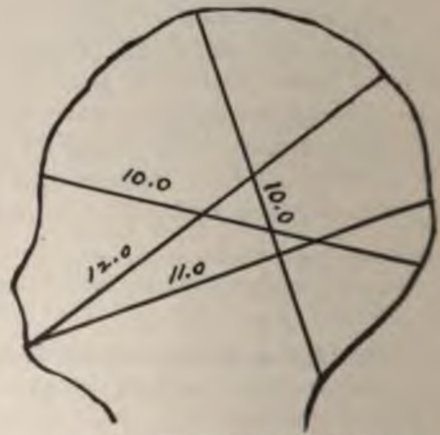

Fig. 253.—Sagittal Section of Head Immediately After Normal, Easy Labor, Half Natural Size. (After Ballantyne.)

Besides the increased resonance, there is an important feature which may be demonstrated: The percussion elicited at a given spot on the cranium, such as the pterion, varies according to the position of the head. While the person sits with the head upright, the most resonant note is brought out by percussion toward the basal level of the frontal bones and the squamous

OUTLINE SKETCHES OF HEAD OF INFANT, SHOWING THE MODIFICATIONS IN FORM PRODUCED BY LABOR, ETC.

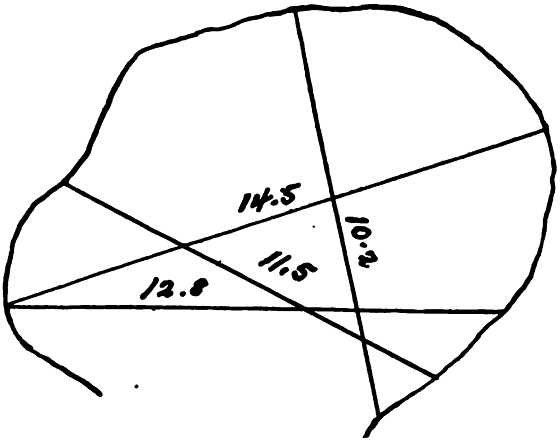

Fig. 254.—Sagittal Section of Head Immediately After Labor (O. D. P. Position). (After Ballantyne.)

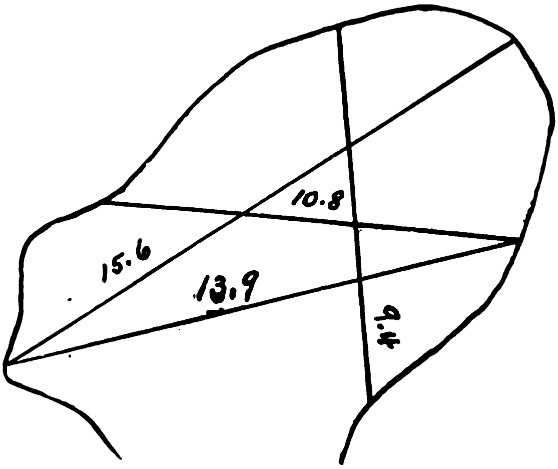

Fig. 255.—Sagittal Section of Head Immediately After Labor, Half Natural Size. O. D. P. Position. (After Budin.)

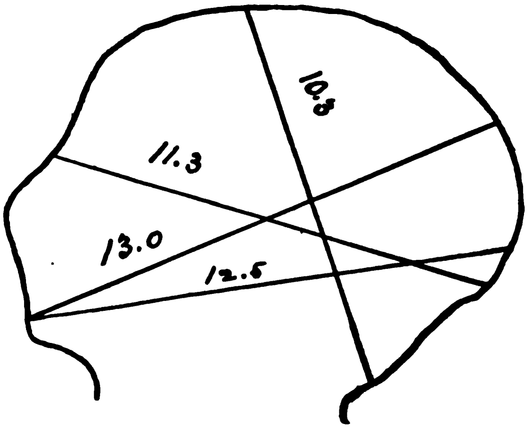

Fig. 256.—Sagittal Section of Head of Infant Six Days Old, Half Natural Size. (After Ballantyne.)

portion of the parietal. If the patient hangs his head to one side, so that one parietal is placed fairly below the other, the greater resonance is found on percussion of the lower parietal. Reverse the position and the same note is elicited on the opposite side of the head, which is now the lower, the greater resonance being found at that part of the skull nearest the lateral ventricles, and which for the time is at the lowest level.

"These observations tend to indicate that the quality of this note is not dependent on the mere density of the diameter of the cranium, but to a large extent upon the consistence or arrangement of the intercranial contents relatively to the osseous walls. . . . The exact mechanical quality of the note is difficult to describe, but, when heard, it conveys the idea of hollowness. One such case, in which the above phenomena were clearly marked, was observed to a conclusion. The percussion note was not so clear at first as it ultimately became, the resonance increasing as the disease advanced.

"In tumors of the cerebellum it is an aid to diagnosis, and when present with abscess it points to an involvement of the cerebral fossa."

THE BRAIN.[1]

In the new-born the dura mater is closely adherent to the skull, so that extravasations between the dura mater and the skull are unknown.

Fluid in the Subarachnoid Space.—In infancy and childhood more fluid is found in this space than in adult life. McClellan believes that "hydrocephalus due to an excessive amount of fluids in the ventricles of the brain may be caused by the closure of a small opening in the pia mater which is found at the inferior boundary of the fourth ventricle known as the foramen Magendie."

Blood-vessels of the pia mater are so delicate that blood pressure, traumatism, etc., may cause hæmorrhage into the subarachnoid space, resulting in monoplegia, hæmiplegia, or diplegia.

Growth and Development of the Brain.—From birth until the seventh year is reached the brain grows very rapidly; after the seventh year the growth is slow.

Weight of the Brain.—The weight of the brain of the new-born infant is one-third that of the adult. In male and female children it is approximately the same at birth, although later on the male brain grows more rapidly than the female. When a child is between 7 and 8 years of age, the brain reaches the adult size and weight. There is from this time on a slight increase in the weight up to the twenty-fifth year.

Vierordt states that the increase of the brain after the seventh year is

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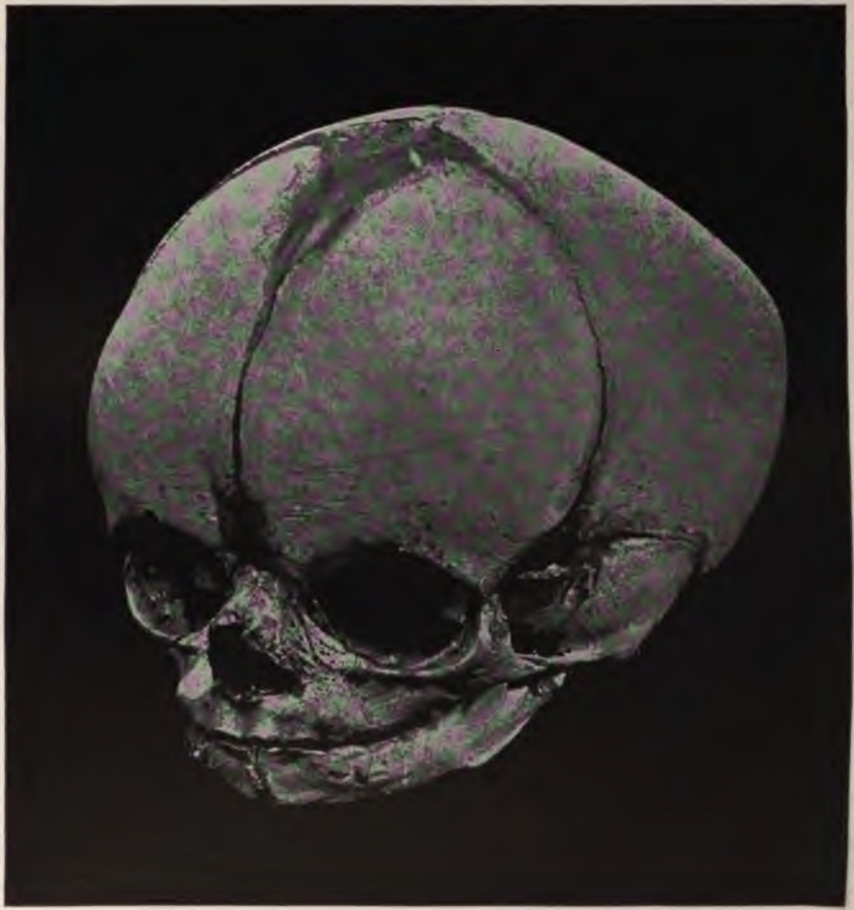
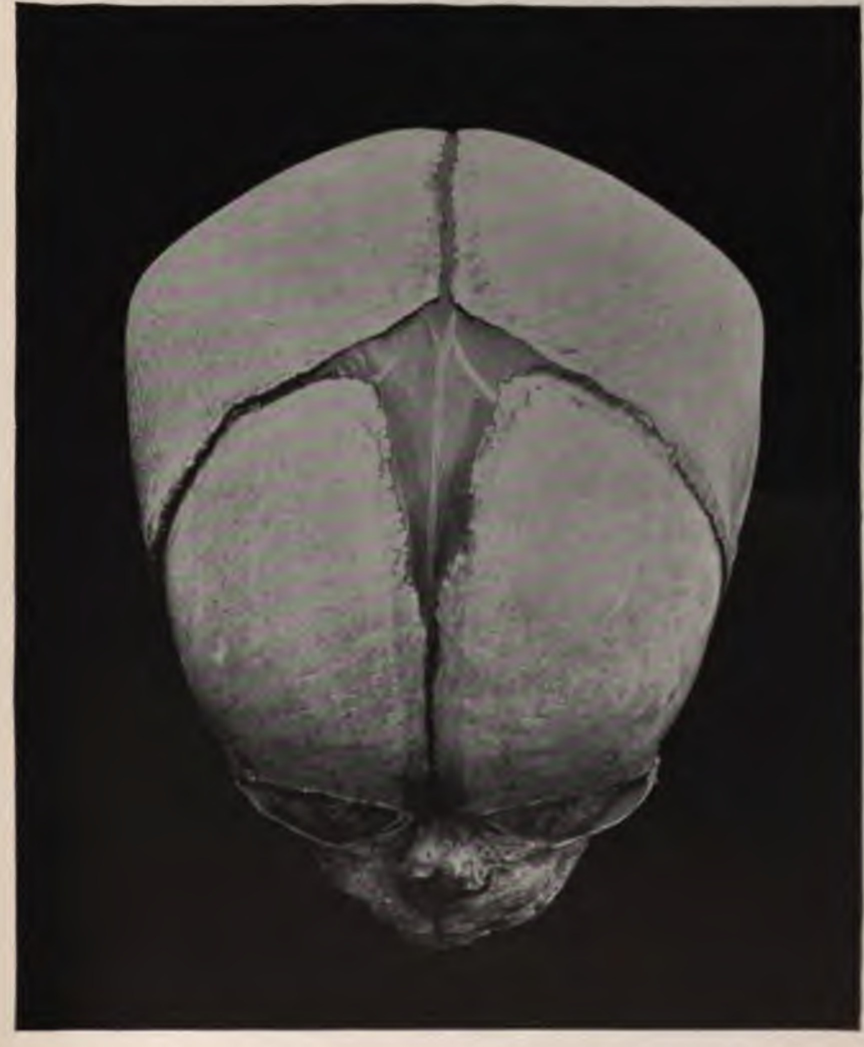
[1] The development of the senses is described in Part I, chapter on the "New-born Infant."

PLATE XXII



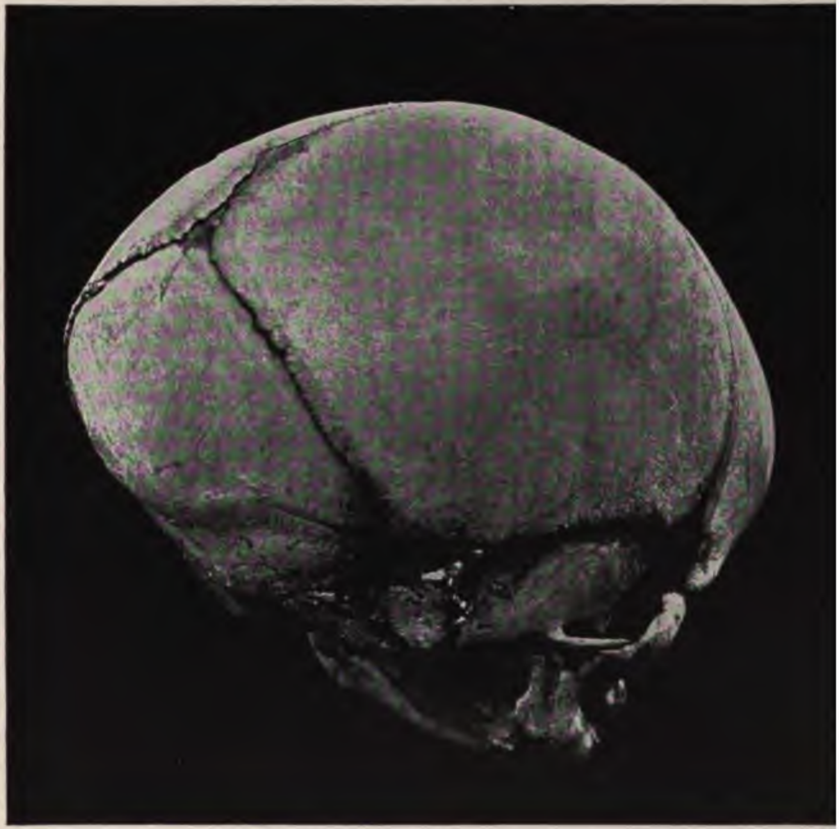
Front View of the Fœtal Skull, showing the anterior fontanelle and the coronal and frontal sutures. (Grandin & Jarman.)

PLATE XXIII



Top View of the Fœtal Skull, showing the anterior fontanelle and the frontal, coronal, and sagittal sutures. (Grandin & Jarman.)

PLATE XXIV



Posterior View of the Fœtal Skull, showing the posterior fontanelle and the lambdoidal and sagittal sutures. (Grandin & Jarman.)

due to an increase in the thickness of the cortex and in the size of the cortical constituents.

Difference Between Infantile and Adult Brain.—The fissure of Sylvius in its relation to the spherio-parietal and squamous sutures occupies a higher position in childhood than in later life. Symington and McClellan, in studying frozen sections of the brain of children under 7 years of age, found the Sylvian fissure above the squamous suture and covered by the parietal bone.

Fissure of Rolando.—The position is the same in the infant as in the adult.

The Cerebellum.—This is much smaller in the child than in the adult in comparison with the cerebrum.

The convolutions of the brain are more shallow in the infant than in the adult. The depressions or sulci between the convolutions are not so deep in the infant as in later life. *The special centers* of the brain are not fully developed in the infant (Taylor and Wells).

REFLEXES.

Excess of Reflex Action.—In acute mania, in cerebritis, and in acute meningitis we have excessive reflex action. In chronic hæmiplegia an increase of the reflexes associated with ankle clonus is found on the affected side. In hydrophobia, transverse myelitis, insular sclerosis, and in tetanus we have an exaggeration of superficial and deep reflexes. Attention is directed to the chapters on "Tubercular Meningitis" and "Epidemic Cerebrospinal Meningitis" for clinical illustrations of the reflexes.

Diminution of Reflex Action.—The reflexes are lessened and sometimes absent in *melancholia.* Extreme pressure in the cranial cavity or in the spinal canal will reduce the reflex act. Whenever a degeneration of muscles or nerves takes place, such as in diphtheria or other specific diseases, the reflexes will be lessened. The reflex is reduced or wanting in acute anterior poliomyelitis.

Babinski Reflex.—In the new-born baby this reflex has frequently been noted under normal conditions. Instead of normal flexion of the toes, which is accomplished by irritation of the soles of the feet, we have in disease *a hyperextension of the great toe.* This symptom is regarded as pathognomonic by some authors. I have frequently found this symptom present in tuberculous meningitis, and regarded it as a valuable diagnostic aid. (See clinical case, article on "Tubercular Meningitis.")

Reaction of Degeneration.—"In health a faradic current of sufficient strength applied to the *nerve* produces a continuous contraction of the muscle; the galvanic, a momentary contraction when the current is made and broken only. When the nerve is diseased a stronger faradic or galvanic current is needed to produce contraction, until finally, when degeneration has taken place, no current which can be used produces any contraction. In health either current applied to the *muscle* produces contraction; the response both to the galvanic current and to the faradic is quick, being in both instances due to stimulation of the nerve-endings. With lesion of the nerve and consequent degeneration of the nerve-endings, the faradic current produces no contraction, but since the galvanic current is capable also of stimulating the muscle fibers themselves, a contraction follows application, though more slowly than when the nerve-endings are healthy. After the degeneration has progressed to a certain stage, which is reached the earlier the more severe the case, this response of the muscle fibers to the galvanic current becomes more ready than in health. To this quantitative change is added a qualitative change. In health the weakest galvanic current which causes contraction of the muscle does so when the current is made with the negative pole on the muscle (kathode closure contraction, K. C. C.). When the nervous mechanism has degenerated a contraction may occur with as weak or with a weaker current when the positive pole is on the muscle (anode closure contraction, A. C. C.), and contractions may occur also with the same current when it is broken (anode opening contraction, A. O. C., and kathode opening contraction, K. O. C.[1]). To this altered qualitative and quantitative reaction of nerve and muscle to the electric currents the term "reaction of degeneration" is applied. It is not always as definitely marked as is above described. When the damage to the nerve is slight, the irritability of the nerve to both currents may be retained, and the only evidence of the existence of a reaction of degeneration is increased muscular irritability to the galvanic current, with some change also in the order of contraction to the poles (qualitative change). On the other hand, in very chronic changes the loss of irritability proceeds *pari passu* in nerve and muscle, and the reaction of degeneration is not to be observed.

"With the regeneration of the nerve, recovery of function takes place, the rate of recovery depending mainly on the severity of the lesion. Voluntary power is first regained, then the galvanic reactions become normal, and lastly, the faradic.

"Anæsthesia, which is the eventful result of degeneration of a sensory nerve, may be preceded by a condition of hyperæsthesia. The anæsthesia is often incomplete, especially in the hands and face; in a mixed nerve a lesion, capable of producing paralysis of motion, may be accompanied by little loss of sensation. Trophic changes seem seldom to occur in children as an accompaniment of lesions of sensory nerves."

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[1] The normal order is: K.C.C., A.C.C., A.O.C., K.O.C.

CHAPTER II.

CONVULSIONS (ECLAMPSIA).

CONVULSIONS occur mostly in infancy. After the seventh year of life they are very rare. The brain grows more during the first year than in all later life. This rapidity of growth is in itself, according to some writers, an important predisposing cause of functional derangement.

Etiology.—*The Exciting Causes.*—The predisposing causes may be grouped under the name of "central." They are:—

1. Diseases having a high temperature.
2. Diseases accompanied by vascular stasis.
3. Diseases characterized by anæmia and exhaustion.
4. Toxic causes.
5. Organic central lesions.
6. Functional disturbances of the brain, such as epilepsy.

Of all the manifold predisposing causes of convulsions in young children, the most important one is the natural instability of the nervous centers, characteristic of early life, and associated with the non-development of voluntary centers of the cortex; hence it is that age is a most important factor in the etiology of convulsions; and under 2 years is recognized as by far the most susceptible period. Statistics show that over 60 per cent. of deaths from convulsions, up to 20 years, occur in infants under 1 year of age. Convulsions are not only more common in infancy, but much more fatal than later in life, and for reasons that are very apparent. It has been stated by some good observers that males seem to be more susceptible than females; statistics seem to justify this conclusion, but it has been suggested by others that inasmuch as more males than females are born each year, the larger number of deaths in males may thus be reconciled, for surely it would be contrary to reasonable expectation, as females are more delicately organized, while the exciting causes are probably about equal.

The Peripheral Causes.—The peripheral causes are rachitis; gastric disturbances, such as acute catarrhal gastritis; intestinal worms; foreign bodies in the ear and nose, causing reflex convulsions; scalds and burns, and mental disturbances, such as fright, will induce convulsions. Lewis says: "Convulsions are in all probability due to an *exaltation* of the *lower* nerve-centers; or more frequently, to a suspension of the inhibitory power of the *higher* cerebral centers"—or both of these conditions may exist at the same time—and further, "It remains to be said that we are still very much in the dark as to the immediate processes producing convulsions."

"Infants have their nervous system in process of rapid development—only the component but undifferentiated parts of which are in great activity, ready to receive and re-energize limitless new impressions." At birth, the lower centers only are developed, and control is limited until the higher centers become competent to exert *inhibition;* hence in the earlier months of life convulsions are common, and less so after two years.

Improper feeding may be looked upon as the most frequent cause of convulsions. A child that is improperly fed and suffers with a subacute or chronic form of dyspepsia, suffers with a deficient structure. Such structural weakness resulting in rachitis, is a cause for that most common form of spasm known as laryngeal spasm and tetany. Toxæmic conditions resulting from bacterial infection are a most frequent cause of convulsion.

Pathology.—The development of the nervous system is not complete at birth. Very little light is shed upon convulsions by post-mortem findings. Usually after death from convulsions there is an effusion or hæmorrhage found or there is a venous stasis in the brain. When death occurs from laryngospasm it results from suffocation. The condition of the brain in the beginning of an attack of convulsion is one of anæmia. This is shortly followed by a nervous hyperæmia. The brain and meninges are usually found intensely congested and engorged. Sometimes punctate hæmorrhages can be found. The lungs are also deeply congested and the right heart is generally distended with dark clots (Holt).

Symptoms.—There is usually a loss of consciousness. The onset is sudden. A child may appear perfectly well up to the time of its convulsion and then suddenly the arms and legs become stiff, the eyes fixed and staring or rolled up under the lids. Respiration is usually arrested, the head is retracted; finally the whole body becomes rigid.

The above named symptoms belong to *the tonic stage.* It is usually followed by clonic convulsions more or less severe and prolonged, affecting the upper and lower limbs, the face and eyes.

Sometimes the tonic and clonic convulsions are few and the whole spasm may last less than a minute. Some children show no sign of illness after the attack is over, and appear perfectly normal. The attack may recur at short intervals. The child may then become comatose and die before proper treatment can be instituted. It is important to examine the urine. The possibility of a nephritis should not be overlooked.

Diagnosis.—It is usually very simple to differentiate from epilepsy, which is most frequent after the third year.

Convulsions usually are the first symptoms of the invasion of an acute disease. Scarlet fever, pneumonia, malaria, gastritis, and meningitis may be ushered in with convulsions. Measles is sometimes preceded by convulsions. Pertussis in which there is cerebral congestion may cause convulsions. Bronchitis, membranous laryngitis, and laryngismus stridulus are sometimes preceded by convulsions. Do not suspect teething or worms as a cause of convulsions until all other causes have been eliminated.

Treatment.—The treatment of convulsions consists of controlling the spasm. Inhalations of chloroform or sulphuric ether should be cautiously used, regardless of the age of the infant, until convulsions cease.

Chloral hydrate and bromide of sodium, with some starch water, should be injected into the rectum; 5 grains each of chloral and bromide with a tablespoonful of starch water should be used and repeated every hour until the spasms are controlled. Leeching by the application of one or two leeches behind the ears is valuable to relieve cerebral congestion. We can also drain blood from the frontal sinus by the application of one or two leeches at the alæ nasi. A mustard foot-bath should likewise be used until hyperæmia of the skin is produced. While the feet are suspended in mustard water an ice-bag or a cold cloth should be applied to the head.

A child, 4 years old, was suddenly seized with convulsions, clonic and tonic spasms involving the face, arms, and legs. From the history I learned that the child had overloaded its stomach, was very feverish, and thirsty. A mustard foot-bath was ordered and a rectal injection of:—

℞ Sodium bromide	10 grains
Chloral hydrate	5 grains

was injected into the rectum with two tablespoonfuls of thin starch water.

One or two inhalations of chloroform were given to relieve the convulsions.

The diagnosis of acute catarrhal gastritis was made and the convulsions attributed to a general toxæmia. When the convulsions ceased the stomach was washed with two quarts of warm water to which two tablespoonfuls of salt had been added. Food was discontinued and an interval dose of:—

℞ Sodium bromide	5 grains
Chloral hydrate	2 grains

was given every hour until the child was in a deep sleep. Twelve hours after the convulsions first began, thin soup and broth were ordered. The child was well in two days.

To control convulsions:—

℞ Sodii bromidi	5 grains
Chloral hydrate	5 grains
Starch water	1 tablespoonful

Mix thoroughly and inject, if possible, into the colon, through a small rubber catheter. Repeat every hour until convulsions cease.

The thorough flushing of the bowel with a pint or two of soap water is always indicated *before the first injection* of chloral and bromide is given. *Do not feed or give any liquids by mouth until the convulsions have ceased.* If no effect is produced by the above-mentioned treatment, then a hypodermic injection of morphine can be given. For a child 1 year old $^1/_{25}$ grain; 6 months old, one-half the dose. Opium is very well tolerated in toxæmic conditions, hence we must not be afraid to repeat this dose if necessary. Fresh air is vital. Oxygen, if handy, is beneficial, and should be given.

The main indication is to control the spasm; secondly, seek the cause and, if possible, remove it.

HEADACHES.

Various forms of headache are encountered in children. As a rule very little reliance can be placed on headaches complained of by young children. There are four kinds of headaches which are most frequently seen in older children:—

1. Reflex headache.
2. Headache due to general systemic cause.
3. Headache of local origin.
4. Headache due to brain lesions.

Reflex Headache.—In chlorotic girls or in anæmic children headache is a common symptom. During menstrual disorders girls will usually complain of headaches.

Hundreds of cases of headache due to eye strain have been seen by me in school children. These children complain of headache during and after school hours. The headache disappears during the night and the children never complain of headache in the morning. Most of these cases have been referred by me to an oculist, who as a rule finds astigmatism. The treatment consists in relieving the eye strain by wearing eyeglasses.

Headache Due to General Systemic Causes.—Headache due to auto-intoxication resulting from impacted fæces is frequently encountered. Rheumatic children and children of gouty parents frequently complain of headaches. Such headaches are frequently found in lithæmia. The general constitutional treatment consists of a diet of vegetables, and fruit. No meat should be given. Five to 15 grains of citrate of potash will usually benefit this condition. A laxative should always be given if headache is due to constipation. Exercise and outdoor play will aid this condition.

Headache Due to Local Origin.—Children frequently complain of headache which is due to intra-nasal neoplasms. At other times such local causes as supra-orbital neuralgia, due to neuralgia of the fifth cranial nerve, will cause an intense headache. In the latter instance gentle massage or a mild current of faradic electricity will relieve. In severe cases the internal administration of $^1/_{500}$ grain of Duquesnel's aconitia, three times a day, will relieve. In persistent headache it is advisable to have the ears carefully examined by a competent aurist. The frequency of middle-ear disease should be borne in mind.

Headache Due to Brain Lesions.—In older children headache of a persistent character, associated with vomiting, should always be looked upon as suspicious of cerebral trouble. A case of this kind is reported by me in the chapter on "Cerebro-spinal Meningitis." In older children suffering with persistent headache it is advisable to examine the fundus of the eye to see if a choked disc is present. In one of my cases a tumor of the cerebellum was diagnosed in this manner.

MIGRAINE (SICK HEADACHE: HEMICRANIA).

This is a headache confined to one side of the head, associated with dizziness and generally vomiting.

Causes.—Overworked school children of a nervous type usually have these attacks. Children suffering with dyspeptic attacks are more frequently the victims of migraine. An indoor life in a crowded apartment will cause this condition. Eye strain is frequently the cause.

Treatment.—Have the eyes examined and correct any abnormality, if present. The diet should be regulated and a laxative dose 10 to 20 grains of phosphate of soda should be given. The value of bromide of soda in Seltzer water, with or without caffeine, should be remembered.

SPASMUS NUTANS.

This condition is frequently associated with rickets. It is characterized by an involuntary and uncontrollable head shake.

Etiology.—It may be associated with or follow traumatism. Fright and other psychical disturbances may cause this condition. Heredity plays an important part in its development. It is usually found associated with rickets. In a case of mine presented to the Section on Pediatrics of the New York Academy of Medicine,[1] spasmus nutans was associated with sporadic cretinism.

Symptoms.—In some cases we see a continuous nodding, in other cases the motion is rotary. In rare cases both motions, nodding and rotary, may co-exist. Nystagmus, which is a movement of the eyes, rhythmical and oscillatory, either vertical or horizontal, may also be present.

Prognosis.—This depends on the cause of the same. As a rule the prognosis is good.

Treatment.—If rickets is the cause give the child anti-rachitic treatment. If it is associated with cretinism, as in the case reported by me, then give thyroid treatment. A change of air and general restorative treatment is also beneficial in these cases. Electricity is not indicated and should not be used. Massage may be tried.

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[1] See Proceedings of New York Academy of Medicine for 1904.

STAMMERING AND STUTTERING.

This is due to a want of coördination among the muscles concerned in articulation. The trouble may be confined to the lips and tongue, or there may be a laryngeal spasm, causing difficulty with the vowel sounds.

Stuttering is usually due to an affection of the neuro-muscular mechanism of articulation proper; besides, the respiratory muscles are usually involved (Williams). Defects of speech may be hereditary, although a neurotic element may be found in children of neurotic parents.

I have seen a severe type of stuttering in a child 4 years old, whose father was alcoholic. Another case I recall was seen as a sequela to septic scarlet fever.

As a rule it is associated with some anatomical or pathological lesion in the naso-pharynx.

"Difficulty with the explosive consonants is the commonest form, but both this and other forms only become serious affections when combined with irregular action of the muscles of respiration. In such cases, during the attempt to breathe, spasm of the muscles of the face, arms, and trunk may occur and increase greatly the distress which the patient suffers."

Treatment.—Systematic instruction in breathing and speaking by a competent teacher. During singing, if attention is directed to breathing, the defect is absent. Persistent treatment by a very patient teacher will usually modify and benefit this condition. Medication is useless unless the child is weak and requires building up.

CHOREA (ST. VITUS' DANCE).

This is a neurosis characterized by irregular involuntary movements of the muscles. It usually affects the muscles of the extremities, face, and tongue. As a rule these movements are not present when the child sleeps.

Etiology.—As a rule this disease is most prevalent between the ages of 7 and 14 years. Chorea generally occurs in bright precocious children. It is seen more than twice as frequent in girls as in boys, and the disproportion becomes even greater after puberty. It is extremely rare in dark-skinned races. Chorea rarely becomes chronic, although it recurs in about one-third of the cases. It is more likely to recur in girls.

Steven Mackenzie[1] reports 439 cases. The largest number of attacks occurred in the thirteenth year.

34 per cent. occurred between	5-10 years
43 per cent. occurred between	10-15 years
16 per cent. occurred between	15-20 years

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[1] British Medical Journal, February, 1887.

Sachs reported a case seen in a child under 1 year of age, and several cases seen in children between 2 and 3 years of age. The reported congenital cases are usually mistaken instances of organic cerebral disease.

Sinkler found that of 328 cases, 232 were females, and 96 males. Gowers studied the statistics of 1000 cases and found 365 in boys and 635 in girls.

Morris J. Lewis, of Philadelphia, studied 717 cases and found that the largest number occurred in March, the next largest number in May, and that the curve corresponds with the rheumatism curve.

My own experience is that we have an equal number of cases occurring in the spring and fall *depending on the amount of study and the sedentary life induced by too much school.*

In a large children's service among the poor tenement population, out of 100 cases of chorea examined by me 80 cases occurred in females; 20 cases in males.

All of my cases were school children who were apparently well when their chorea commenced.

Overstudy in School.—Sturges, in London, has given considerable attention to the question of overstudy, and he believes that it is an important etiological factor in the causation of this condition. Overstudy (apparent) may mean only inability to study due to lack of mental concentration.

Chorea frequently follows the infectious diseases. It is seen after scarlet and typhoid fever. I have seen chorea of a very severe type follow a fright and also after bad dreams, in school girls. Reflex causes, such as phimosis, pin worms, and delayed menstruation, are cited by some authors.

Reflex Causes Due to the Eye.—I have usually sent children suffering with chorea to the eye specialist to see if improvement could not be obtained by using eye-glasses. I believe that headaches due to astigmatism can be relieved, so also can astigmatism be modified when suitable glasses are prescribed. I do not believe that the chorea *per se* was cured in a single case. I do not refer to those cases of habit spasm so frequently seen in nervous children, but I refer to distinct chorea.

A series of cases of chorea were under the treatment and observation of Dr. Herman Jarecky at the Manhattan Eye and Ear Hospital. He reported no improvement directly due to the wearing of eye-glasses.

Reflex conditions, such as adenoids and polypoids, have been reported from time to time.

The reflex causes are overestimated. Adenoids are more likely to induce tics rather than chorea.

Neurotic make-up plays a distinct predisposing rôle (neuroses or psychoses in family).

TABLE No. 101.—*The Association of Chorea with Rheumatism.*

Steiner reports	252 cases	4 suffered with rheumatism
Sachs reports	70 cases	8 suffered with rheumatism
Sinkler reports	279 cases	37 suffered with rheumatism
Crandall and Holt report	146 cases	63 suffered with rheumatism
Fischer reports	100 cases	25 suffered with rheumatism

Twenty-five Per Cent. of my Cases had Undoubted Rheumatism.—By rheumatism I include cases that complained of pains in or around the joints. At times they were described as "growing pains" by the parent.

Frequency of Endocarditis.—Valvular lesions have been seen by me in chorea without any antecedent joint lesions. The ease with which rheumatism is overlooked in children makes the clinical history as given by parents doubtful. It is, therefore, possible that there are many more cases of rheumatism associated with chorea than are reported.

Association with Tonsillitis.—Of the 100 cases of chorea previously reported by me, more than 80 cases had enlarged tonsils. It seems quite probable that *the tonsil is the point of entrance* of the pathogenic bacteria which cause chorea, and most probably rheumatism and endocarditis.

Pathology.—There are no distinct pathological lesions which can be attributed to chorea. Sachs says that the pathology of chorea is still a great mystery. Not that autopsies are wanting, but there have been so many different post-mortem findings described that each writer may be said to have his own views concerning the pathology of chorea.

Symptoms.—Chorea usually begins with prodromal symptoms. The children as a rule are very irritable, depressed, and cannot hold their arms or legs quiet. They complain of pain in various parts of the body. The main symptoms which attract the attention of parents or nurses are motor disturbances. These consist of involuntary twitchings affecting various muscles or groups of muscles. The muscles of the hands, the legs, the facial muscles, and the tongue show this choreic twitching. At times there is a decided interference with speech. A point worth noting is that the child cannot control these movements voluntarily. The greater the effort to control these movements, the more the twitching will be noticed. Sachs emphasized the fact that in doubtful cases *choreic movements of the tongue* will often prove the nature of the disease. This I have frequently been able to verify when it was a question of habit spasm or true chorea. There is a certain awkwardness which is typical in a choreic patient. This can be noticed when the child attempts to do anything. Choreic movements *do not occur* as a rule in the night when the child sleeps. The pupils are frequently dilated. Children are sometimes punished at school for restlessness which is the beginning of true chorea, and it is only later in the disease that the true character of the same is detected. In some cases but one-half of the body (hemi-chorea) is affected. In other cases choreic movements are stronger in the upper than in the lower extremities. Children seem to suffer muscular weakness and there is loss of muscular power. A peculiarity of chorea is that in spite of the constant muscular twitching there is little exhaustion. The reflexes show no abnormality.

Condition of the Heart.—Very frequently a systolic murmur has been heard during the course of chorea. This systolic murmur persists for months after the last symptoms of chorea disappear. Pains in the large joints are frequently described. I have invariably noted a slight rise in the temperature (101° F.) when the joint pains or endocarditis existed. When chorea appeared without evidences of cardiac or arthritic complications the temperature *invariably remains normal.*

Fannie S., 11 years old, was a very anæmic girl. She had been sick for two months with tonsillitis and influenza. She was compelled to stay away from school, and in order to catch up with her class, studied very hard, especially at night, until she passed her examinations.

History Given by Mother.—The child complained of headache, her appetite was poor, the bowels constipated. She was restless by day and did not sleep well at night. She had nervous twitchings of the arms and legs. The fingers were never still. She did not appear contented at anything. Her eyes were examined by an oculist, who prescribed eyeglasses. He said the child had eye strain. The mother believed there was a slight benefit after wearing the glasses.

When the child was brought to me, there were distinct evidences of chorea, with twitchings of the face, the tongue, the hands and the legs. Four drops of Fowler's solution was prescribed, three times a day, and gradually increased until 7 drops were given three times a day. All school and study was stopped. Cold sponging and a cold shower was ordered every morning and evening. Cereals, vegetables, milk, and fruit were given. All meat was stopped. An active outdoor life and all quiet games and sports were recommended. Under this treatment the symptoms gradually subsided and the child recovered. One year later the same symptoms returned, and it was found that the cause of the relapse was overstudy. I prescribed "remove the cause," namely, take the girl away from school.

Course.—The usual course of this disease is from six to ten weeks, although it may extend to four months. I have seen cases in which there was a severe attack in the spring, which seemed to disappear entirely during the summer, and suddenly reappear with greater intensity in the fall.

Prognosis.—The outcome of a case of chorea is usually good, especially so if we are dealing with intelligent mothers and nurses. The prognosis is bad if endocarditis or other organic lesions are associated.

Treatment.—*Rest Treatment.*—It is useless to attempt to modify severe or mild chorea without enjoining absolute rest in bed. The eyes should be protected from a strong light, or the room should be darkened by drawing the shades. In some cases I have kept children in bed for one week before the twitchings ceased. In severer cases it may be necessary to keep a child in bed at least two or more weeks. *The soothing influence of this* absolute ***rest in bed*** will do more good than all the drugs **combined.**

Hygienic Treatment.—A child should be removed from school and thus guarded against all psychical disturbances. Cold sponging of the entire body and cold spinal douches have been found very beneficial.

The diet should be light and very nutritious. All cereals should be given (see diet list for a child from 3 to 10 years old, page 154). Meat should be avoided, although meat soups and white meat or chicken may be permitted. Later fresh air and quiet out-of-door exercise, games, and sports are necessary adjuncts in the treatment of this disease.

Medicinal Treatment.—Iron and arsenic should always be remembered in the treatment of this disease. We can begin with 4 or 5 drops of Fowler's solution, three times a day, and watch the systemic effect, with gradually increasing doses until 10 drops, three times a day, are given. Great care should be used to avoid arsenical poisoning when large doses of Fowler's solution are given. In some children a peculiar idiosyncrasy exists which renders them liable to systemic poisoning. Semple has reported multiple neuritis following the use of arsenic in the treatment of chorea. I have seen multiple neuritis in a rachitic child having chorea minor. The child received 4 drops of Fowler's solution for six weeks. When the arsenic was withdrawn, the neuritis subsided. Of the preparations of iron on the market, neoferrum in doses of 1 or 2 teaspoonfuls has served me very well. Another preparation which I have frequently used is the liquor ferri peptomangan (Gude) in doses of a teaspoonful, three times a day, after meals. Ferratin, 5 to 10-grain doses, three times a day, after meals, is also beneficial. Antipyrin and bromide of sodium may also be used in some cases. When chorea is associated with rheumatism, the salicylate of soda in 3 to 5-grain doses, or salipyrin in the same quantity, may be given three or four times a day. Some authors advise against the use of chloral hydrate; my personal experience with 2-grain doses of chloral hydrate given morning and evening has been very good. If choreic twitching does not improve after several weeks of persistent treatment, then a cold pack may be tried. A sheet wrung out in cold water at a temperature of 60° F. should be wrapped around the child for one hour every morning and evening. Not only have I seen a soothing effect on the nervous system from these packs, but they frequently promote sleep. That electricity is of value in this condition is doubted by many. I have seen one or two cases in which excellent results were obtained from the use of a weak galvanic current over the spinal nerves. On the other hand I have frequently seen no effect whatsoever from the treatment with mild or strong galvanic currents.

Sachs recommends hyoscyamin in tablet form, $^1/_{100}$ grain, when restlessness and insomnia exist. Hyoscyamin should only be administered in the afternoon and evening. Massage is sometimes of value in conjunction with electricity; it has a soothing effect on the nervous system and stimulates nutrition. It is especially valuable at night and I have seen a profound sleep follow thorough massage of the body.

HYSTERIA.

It is an important matter to recognize this condition when met with in children. It is rarely seen in children under 7 years of age, although cases are on record of distinct hysteria having been met with in infancy. In my experience children rarely simulate disease. I have seen children imitate an invalid mother and complain of imaginary pains and aches at the same time and in the same portions of the body as the mother. Very neurotic children, susceptible children, and children having bad habits, such as masturbation, are more prone to develop hysteria. Charcot maintained that hysterical persons are hysterical because they are mentally degenerate.

Pathology.—Hysteria is not a fatal disease, hence we have no specific pathological lesions. The theory concerning the mobility of the neuron, while very interesting and scientific, does not explain the hysterical paroxysms. Hysteria is not a psychosis as is generally supposed. There are no known demonstrable lesions. While in some cases the whole brain seems disturbed and involved, in other cases but one-half of the brain is involved.

Symptoms and Diagnosis.—Paralyses occur in hysteria which simulate those due to central nervous disease. As a rule, however, they disappear. The hysterical paroxysm usually follows close upon an aura. It sometimes comes on suddenly, although it may be preceded by a spell of laughing or crying. Children old enough to complain describe a "lump in the throat" similar to the "globus hystericus" which occurs in the adult.

Some symptoms closely resemble epilepsy. Headache is complained of at times. The screaming and shouting gradually cease as the attack subsides. The following description given by Taylor and Wells describes the attack so closely that I repeat it: "The patient sinks down or falls prone upon the back, with the limbs extended and rigid, but with the fingers and toes flexed; the eyes are usually rolled slowly from right to left, or crossed; the jaws are firmly closed; the breathing becomes slow and labored, and later hurried, the face flushed or bluish, the neck turgid; the cardiac action becomes more rapid and forcible, and consciousness is almost, but never entirely, lost. Sensation is much obtunded, and abolished in some portions of the body. Soon clonic movements succeed—a tremor affecting the muscles of the trunk, extremities, and face. This alternates with electric-like startings, during which the patient may fling himself furiously about, or actually out of bed. Presently this stage ends with sighs, and is followed by a short sleep." Some authors describe a series of dramatic movements. There may be opisthotonos. The child may have a bowing of the lumbar curve so that it rests upon its head and heels

There may be a series of attacks recurring so that as many as two hundred paroxysms have been recorded by Sachs. I have seen a severe form of hysteria with over ten paroxysms during one hour. Some tender areas frequently noted in children, over the ovaries and spine in girls, and the testicles of boys, are very sensitive. Some authors claim that pressure over these areas will sometimes invite an attack of hysteria; on the other hand pressure over these same sensitive areas will sometimes stop an attack.

Vomiting when it does occur is a very serious symptom. We do not have the same forms of tremor as are seen in adults.

Borborigmus (rumbling gas in the intestines) is occasionally heard in this condition.

Epidemics of hysteria are frequently described. J. Madison Taylor describes one occurring in a church home at Philadelphia. I have frequently seen children in one locality suffer with various manifestations of hysteria, in which we could easily trace the origin to one particular child.

Prognosis and Course.—The duration of the disease depends on the surroundings of the child. Mild hysteria will sometimes disappear after a change of scene and air of several weeks. In some instances a case may last years or through the child's whole life.

It is always well to remember that hysteria is difficult to cure. If a child is sensitive and subjected to impressions from a neurotic family, then a cure will be difficult. The outcome of any case of hysteria depends on the character of the surroundings and on the mental influences with which the child is brought in contact, rather than on drug treatment.

CASE I.—A girl 9 years old was brought to me for the relief of headache. She complained of a continual headache night and day. The appetite was poor, the bowels moved sluggishly. She was restless during the day, and had insomnia at night. She complained of bad dreams. She looked haggard and worn, as though she were convalescing from some severe illness. She was anæmic and had cold extremities. Heart, lungs, liver, and spleen were normal. She was a very restless child with marked hyperæsthesia. The patellar reflexes were exaggerated.

Subjective Symptoms.—The child complained of pain in every part of her body. On being asked, "Does your side hurt?" she answered, "Yes, my pains are in the side and in the back, just like my mother's." I referred the child to an oculist for an opinion as to the eyes, and his answer was: nothing abnormal, no astigmatism. The child cried on the slightest provocation, and was also almost convulsed with laughter for trivial matters. The diagnosis was hysteria. The child had a headache, or a backache, and always complained of some ache. It was quite evident that the child's hysteria was due to *suggestion by the mother, who was an invalid.*

The treatment consisted in removing the child to an aunt in a neighboring city, amid healthy surroundings. Iron was ordered to build up the system, and bromide of soda in 10-grain doses was given every night for one week, later every other night. Electricity, the baths, and massage were used with great success. In three months the child had rosy cheeks, slept well, was cheerful, and did not complain of any pain. It was strange, however, that when taken back to her mother, she immediately relapsed into her former habit of complaining. We determined to remove her permanently, and she remained well for over a year when I last heard of her.

CASE II.[1]—*General Hysteria and Nervous Vomiting.*—A girl 12 years old was brought to my children's clinic for the relief of vomiting. She was very nervous and complained of pains all over her body. She complained also of pains in her stomach before and after eating. Her mental condition was poor, the hands and feet were cold. She complained of epigastric pains for the last six years. From the mother I learned that the child was frightened by a dog and since that time she has been very sensitive to the slightest impression. The gastric contents were syphoned off, after a test meal and a hyperchlorhydria was found. The urine contained acetone.

The treatment of this case was most successful when large doses of bromides were given.

Treatment.—Study the cause or causes, and remove them if possible. Change the surroundings of the child by removing to a cheerful but quiet home. If the case occurs in the country, bring the child to the city. In any event the main point should be to change the entire scene and surroundings. If a child is in an institution, remove it from the same if it is at all possible. The person in charge of the child should be either a very intelligent mother having a positive influence over the child, or a mild-mannered trained nurse. All orders of the physician should be strictly obeyed without having the child feel that vigorous treatment is being used. This psychosis requires educational treatment as has just been described.

Hygienic Treatment.—If the child is old enough, a walk should be ordered several times a day. The bicycle and horseback are valuable adjuncts. The sponge bath or the tub-bath aided by a cold shower or spray chiefly over the spine, head, and neck, have very tonic properties.

Hydrotherapy properly used is one of the most valuable aids in promoting a cure.

Nothwithstanding the shock of a cold spray, the same should be ordered winter or summer.

After the bath the body should be rubbed vigorously, or better yet, massage should be given. I have always found a very soothing effect on the nervous system by giving gentle but thorough massage. Another remedial agent which must be used regularly is electricity. This should be used daily by means of a mild faradic current, one electrode to be applied over the spine, the other over the phrenic nerve. If no benefit is noticed after this treatment is tried, then static electricity can be used.

MULTIPLE NEURITIS (POLYNEURITIS).

This is frequently termed a peripheral neuritis, as it is an affection of the terminal branches of the nerves. It usually affects all the nerves of the limbs on both sides of the body. Starr gives the following classification:—

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[1] This case was presented by me to the Section on Pediatrics, Academy of Medicine, February 14, 1901.

"1. Toxic cases due to the action of a poison derived from without the body. These poisons are alcohol, carbonic oxide gas, bisulphide of carbon, the coal-tar products, especially sulphonal and trional; and nitrobenzol; also, arsenic, lead, mercury, copper, phosphorus, and silver.

"2. Infectious cases due to some agent acquired or developed within the body, as an accompaniment or sequel of diphtheria, grippe, typhoid, typhus, malaria, scarlet fever, measles, whooping-cough, smallpox, erysipelas, and septicæmic conditions, including gonorrhœa and puerperal fever, epidemic forms of beriberi or kakke, and leprous neuritis.

"3. Cases due to general diseased states of the body whose origin is undetermined, such as rheumatism, gout, diabetes, anæmia, marasmus, general malnutrition consequent upon tuberculosis, syphilis and senility, carcinoma, and local malnutrition produced by arterial sclerosis.

"4. Cases due to exposure to cold and developing spontaneously without known cause."

The most common type of multiple neuritis met with in children is either the diphtheritic type or that resulting from poisons in the blood, such as the prolonged administration of Fowler's solution (arsenical poisoning).

Symptoms and Diagnosis.—Multiple neuritis may come on suddenly or the onset may be gradual. The special senses are rarely involved in this condition. The motor symptoms are as marked as the sensory. Paralysis comes on first as a muscle weakness, and gradually increases until distinct paralysis is present. The extensor muscles of the wrist, hands, and feet give the wrist-drop and the foot-drop. Very rarely the muscles of all four extremities in addition to the muscles of the trunk and neck are involved. The knee-jerk usually disappears early when neuritis follows diphtheria. The paralyzed muscles are relaxed, flabby, and atrophied. An important symptom is that faradic excitability is absent and that the muscles respond to a galvanic current only. This symptom is identical with that found in acute anterior poliomyelitis. The reaction of degeneration is present.

There is usually no incontinence of bladder and bowel. Atrophy is another prominent symptom. The condition is similar to that seen in poliomyelitis. There may be other vasomotor disturbances such as unilateral flushing of the skin, or small areas may show a high glossy flush. This last symptom was very prominent in one of my cases. An œdema of the affected parts is described by some authors. As a rule the areas affected are very sensitive, so that we have distinct hyperæsthesia. In other cases the opposite condition prevails and there are areas of local anæsthesia. The disease may be ushered in by a fever. The temperature may rise to 103° or 104° F., and remain several days. The pulse-rate is correspondingly increased and may reach 140 or 160.

Gastric disturbances associated with diarrhœa may be present. The spleen is frequently enlarged, and an examination of the blood will show a distinct leucocytosis, the latter condition when neuritis is a sequela to an infectious disease.

Course and Prognosis.—As a rule, multiple neuritis lasts from several weeks to several months, and then ends in recovery. The cases seen by me associated with chorea in which arsenical poisoning took place, invariably improved when the drug was withheld for a short time. Rarely does the paralysis remain permanent. The prognosis can best be gauged by noting the electrical reactions. If the reaction of degeneration is present after the disease has lasted several months, then a permanent lesion must be suspected. If, on the other hand, there is only a slight difference in the reaction following the use of the faradic current, then a complete recovery may be expected. Some cases, although severely atrophied, will ultimately recover. If myelitis complicates this condition, the prognosis is serious.

Treatment.—The system should be strengthened with proper nutrition. The patient should be made as comfortable as possible. If severe pains exist, then large doses of bromide should be given, with or without codeine, until all pain is relieved. In some cases the local application of warmth over the affected limb is very soothing. I frequently use a warm bath at night, which is very soothing and promotes sleep.

Gentle friction and massage are beneficial. Restoratives, such as cod-liver-oil, maltine with hypophosphites, and iron should be used. The syrup of the iodide of iron is a good restorative. Butter, cream, and cereals are excellent tonics. Strychnine and nux vomica are valuable if the appetite is poor; otherwise they have no specific value.

PAVOR NOCTURNUS (NIGHT TERRORS).

Children apparently healthy will sometimes awaken from a sound sleep and shriek or scream.

Etiology.—In this condition children usually show some disturbance of the stomach or bowels which may have been the exciting cause of the night terror. Reflex irritability is frequently caused by intestinal worms, by adenoid vegetation, or in the male child by an elongated prepuce, or by phimosis. Such children usually possess a neuropathic constitution by inheritance. Henoch states that some children may have hallucinations during the day. These attacks occur but once during the night, and after reassuring the child that there is no danger, it will again fall asleep.

Symptoms.—Some children awaken frightened and screaming, while others will grasp anything within reach in a bewildered manner. They frequently imagine that animals are in the room. The effect of too rigid discipline will sometimes show itself by bad dreams at night, and in a distinct hysterical symptom, such as fright and terror.

Course and Prognosis.—If these night terrors are associated with mild nervous attacks during the day, or if they partake of the nature of epileptic attacks, then a cautious prognosis should be given. The inclination to serious brain or nervous trouble must always be remembered; therefore, no opinion should be ventured until a case has been properly observed.

Treatment.—Children having night terrors should be removed from school to insure perfect tranquillity. There should be a distinct change of scene, a change from the city to the country, or *vice versâ,* will be beneficial. Any reflex cause, if present, should be attended to, and, if possible, removed. Fresh air, out-of-door life, and restoratives are indicated. Such children appear less frightened if they sleep in the room with an adult, and are thus reassured that there is no danger present.

Cold or gradually cooled bathing or a spray over the spine will tone the nervous system. It should be used in a warm room daily. Five grains of sodium bromide may be given before retiring.

MASTURBATION (ONANISM).

This habit is very frequently seen in children. I have seen it in girls as well as in boys.

Causes.—Any irritation of the genital tract that will cause itching may be the origin of masturbation. In boys an elongated prepuce, or friction from phimosis, may give rise to this condition. Very acid urine may cause excoriation and thus invite this bad habit. Excoriations at or near the external meatus may be the starting point. We see this condition quite frequently in girls when preputial adhesions due to smegma or dirt cause an irritation of the clitoris or when pin worms wander from the anus to the vagina; thus worms frequently set up an irritation resulting in masturbation. A diaper if too tightly pinned can set up an irritation, especially in female children.

Symptoms.—Children usually place their hands on the genitals and masturbate. They sometimes rub their thighs together until exhausted. During this friction their face will be flushed and they appear irritable.

Such children suffer with profound anæmia as the result of this habit; and from loss of sleep. Older children, especially boys, will masturbate chiefly at bedtime. They are peevish, irritable, and very sensitive.

An infant about nine months old was seen by me in consultation with Dr. L. F. Harris, of New York City. The mother complained that the child continually rubbed its thighs. The face was flushed during the rubbing; later the child would fall asleep as though from exhaustion. This condition seemed to occur chiefly when the child was placed on the bed or held on the lap. An examination of the genitals showed that they were very red and excoriated from the constant irritation.

The prognosis is usually good if the habit is detected early and the cause removed if one exists. On the other hand, some cases will persist in spite of careful treatment, and nothing but heroic measures will effect a cure, as the following case will illustrate:—

An infant, female, was brought to me for the relief of this condition. The child had masturbated continually for several months and was so emaciated that the parents were alarmed. The condition was so bad that the child masturbated whenever the thighs were put together. A pad was improvised to separate the thighs and local applications of lead water on cotton were placed over the genitals to reduce the irritation. Large doses of bromides were administered to control irritability in the nervous system. The child was kept in a stupor for several days without having the condition relieved. The symptoms persisted and we finally were compelled to remove the child to the St. Marks Hospital where Dr. H. J. Garrigues suggested performing a clitoridectomy. This case was published *in extenso* in Archives of Pediatrics, May, 1899. The child made a perfect recovery. The habit did not reappear.

Treatment.—Remove the cause if any exists. All irritants, such as worms or eczema, should be treated. If an enlarged prepuce causes this condition, remove it. If a vaginal discharge exists, treat it with astringents, and thus avoid irritation. If worms are present, injections of quassia will dislodge them (see chapter on "Worms"). In older children we must remove the child from bad company, and sometimes it will be necessary to change the entire surroundings of a sensitive but well-meaning child. An ocean voyage is beneficial. The system should be strengthened by giving iron and strychnine. Clean habits, a rigid hygiene, and a daily bath are necessary. Strict supervision by night as well as by day with the aid of a trained nurse will do more good than medicine. Children once detected with this bad habit must never be permitted to sleep with their hands under the bedclothes.

Circumcision is one of the most valuable means of curing this habit. In females, especially in little girls, stripping the clitoris and cleansing the smegma, if present, will frequently modify this habit. If the habit persists in spite of this treatment, then a radical operation (see clinical case given) may be required.

CHAPTER III.

TETANY.

TETANY is a nervous disorder characterized by tonic spasms, chiefly affecting the hands and feet. They are known as carpo-pedal contractions or sometimes as arthrogryposis.

Etiology.—Intestinal toxæmia is presumed to be the etiological factor. Tetany is usually found in infants under 2 years of age. Laryngismus stridulus is frequently associated with it.

It is intimately associated with rickets and with other diseases resulting from improper nutrition, such as athrepsia and dyspeptic conditions. It frequently follows diseases which exhaust the vitality of an infant, such as broncho-pneumonia, typhoid, or whooping-cough. It is very often noted when these diseases have lasted a long time.

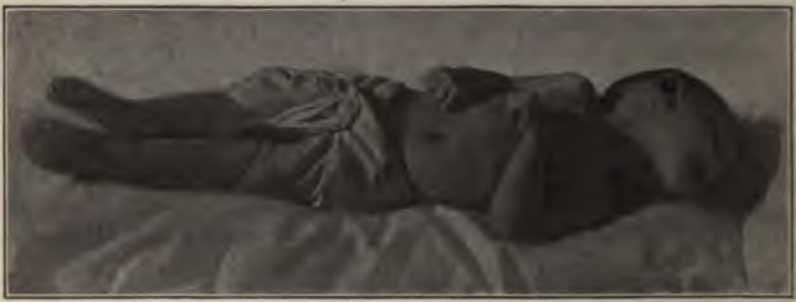

Fig. 257.—Tetany. Characteristic attitude of the hands resembling a rider reining in his horse. Note attitude of the toes. The wrists are rigid and flexed. The elbows are free. The fingers are flexed at the metacarpal-phalangeal joints. In this case facial irritability was best seen by constant spasm in the orbicularis palpebrarum. (Original.)

Facial irritability is not uncommon in older children, and it occurs with them not only in tetany and certain other nervous conditions, but with slight dyspeptic disorders, and sometimes apart from any ascertainable disease. In young children it is common, but it is rarely, if ever, found before the sixth month. It occurs in most cases of laryngismus. When met with alone in children under 3 years old who have any sign of rickets, it may, practically always, be regarded as a danger signal, showing a state of abnormal nervous excitability and a probable tendency to more serious neuroses. Under these circumstances, therefore, it must be taken as an indication for prompt sedative, tonic, and especially anti-rachitic treatment.

Symptoms.—If we tap the muscles of the jaw, a slight contraction of the face ensues. This is known as the *facial phenomenon,* and was first described by Chvostek. The contractions are first seen in the orbicularis palpebrarum.

The contraction resembles that caused by the sudden passage of a galvanic current. It is sometimes more marked on one side of the face than the other; and, in some cases, it is more noticeable in the upper; in others, in the lower half of the face. A similar contraction of the inner end of the eyebrow may often be caused by tapping on the temple. The wrists are rigid and flexed. The elbows are free. The fingers are flexed at their metacarpo-phalangeal joints. There may be a constant spasm, jerking in character, continually present.

A similar phenomenon is known as *Trosseau's sign;* if the arm is compressed by an elastic band the muscles of the fingers and sometimes of the forearm pass into the tetanic condition.

Kassowitz maintains that laryngeal spasm is a symptom of tetany and that its occurrence is pathognomonic.

Course.—The course of this disease is given by some authors as from a few days to several weeks. In one case observed by me at the Willard Parker Hospital (see Fig. 257), the tetanic spasms lasted for more than two months. Other cases seen by me lasted but a few days or weeks at the longest.

Prognosis.—The prognosis is excellent if the cause of the tetany is a gastro-intestinal disorder.

There are instances in which death has ensued from laryngeal spasm or from general convulsions. When a very frail infant has severe tetany of the upper and lower extremities with retraction of the head, then the prognosis is bad.

Gowers reports cases of tetany followed by muscular atrophy.

Treatment.—It is advisable to cleanse the gastro-intestinal tract by giving calomel from $^1/_2$ to 1 grain, repeated if necessary. Castor-oil is a safe remedy. Rhubarb and soda is also a good corrective. If the child is over 1 year old, then a wineglassful of citrate of magnesia will be useful.

Stomach washing should not be resorted to, as there is a risk of causing laryngeal spasm by this procedure. If the child cries owing to pain caused by the tetanic spasm, then chloral and bromide should be given. A warm bath is generally well borne. Belladonna or atropine is useful when given in full doses. Salol and bismuth with calcined magnesia are very good intestinal antiseptics.

Tetanoid condition has been reported by Maestro after the extirpation of the thyroid gland. For this reason the extract of the thyroid gland has been advocated for the relief of this condition.

TETANUS[1] (LOCK JAW).

This acute infectious disease is caused by the invasion of a specific micro-organism.

Etiology.—Any open wound on the surface of the body can be the point of entrance for these pathogenic bacteria.

There are some parts of our country in which the disease exists all the year round, provided the factors which cause the same, filth and dirt, are brought into play. A child infected with tetanus can transmit the disease, hence this should be borne in mind while a case is under treatment.

Bacteriology.—Nicolaier in 1884 found a specific micro-organism in the soil from which he infected animals and produced tetanus. He also found this germ present in patients affected with tetanus.

In 1898 Kitasato demonstrated this bacillus in pure culture. It was also found in infants suffering with tetanus. From the pure culture Kitasato and Behring produced an antitoxin.

The toxin generated by tetanus is a deadly poison. Kitasato found that an animal which was infected and left alone died in one hour.

Pathology.—Distinct lesions of tetanus cannot be demonstrated pathologically. An open wound and evidences of a general septic infection can usually be found. Hæmorrhages of the brain or smaller hæmorrhages in various parts of the body may exist. If the umbilicus has been the point of entrance, the wound will not heal.

Symptoms.—In the new-born the first symptom noticed is the refusal to take the breast. Owing to the rigidity of the muscles the jaws will be found stiffened and feel hard to the touch. The same spasmodic stiffening will be made out in the other parts of the body. After a sudden stiffening the muscles usually relax. Muscular rigidity appears in paroxysms and may come on every few minutes.

The temperature varies between 101° and 104° F. or there may be hyperpyrexia reaching 107° F. The pulse is small, feeble, compressible, and very rapid. Symptoms of malnutrition, such as emaciation, are very evident. Stadtfeldt reports 88 fatal cases; 83 of these died between the ages of six and ten days.

The following case illustrates tetanus seen in private practice:—

A female infant fifteen days old was seen by me suffering with fever. The nurse said that she refused the breast. The infant was in good health apparently up to this time. The appetite was good, the bowels regular, no gastric disturbances existed. On examination the umbilicus was found inflamed and suppurating. The temperature was 102° F.; the pulse 160. The jaws were fixed. The infant had spasms, which grew more severe when she was handled. The body relaxed for a few minutes at a time.

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[1] Owing to the specific effect of the tetanus bacillus on the nervous system, I have purposely placed this article in the chapter dealing with lesions of the brain and nervous system.

The treatment consisted in cleansing the wound with strict asepsis, dusting europhen powder on the umbilicus, and protecting the same with a sterile bandage. The rectum and colon were flushed with warm saline solution. An injection of 5 cubic centimeters of antitetanus serum was given with the usual antitoxin syringe. As no effect was evident from the injection, a second injection of 5 cubic centimeters was administered twelve hours later. Symptoms of improvement followed and the child recovered.

A second case of tetanus was one caused by scratching an open wound situated near the nose, while playing with a canary bird. Symptoms of tetanus appeared two days after infection. This case was also seen in consultation by Dr. George F. Shrady. Large quantities of tetanus antitoxin were injected with no beneficial result. The case ended fatally. In this case the infection was traced to some canary birds which were in the same room as that occupied by the family.

Prognosis and Course.—The duration of fatal cases is seldom more than one or two days. Those tending to recovery usually extend from one to three weeks.

While occasionally cures are reported, five out of ten seen by me have ended fatally. I have seen cases both in this country and abroad, injected with sufficient antitoxin, end in recovery.

Treatment.—The bromides of potassium and sodium, chloral hydrate, belladonna, and opium are among the anti-spasmodics used. It is essential to give large doses or no effect will be produced. Calabar bean has been lauded by some authors and can be given hypodermically.

The literature records a great many cases where the antitoxin was injected directly into the brain. In the new-born baby this method should be used, as there is no obstacle to the introduction of the needle through the open fontanel.

In one case treated by me the antitoxin was injected through the anterior fontanel.

EPILEPSY.

Epilepsy is frequently seen in very young children. Some writers state that it develops in children approaching puberty. I have seen epileptic spasms in children under 1 year of age.

Etiology.—Children whose parents are drunkards or where nervous diseases exist are predisposed to this condition. According to Berkely, 33 per cent. of these cases give a history of alcoholism in one parent. Rachitic infants are frequently seen with epileptic seizures, so that it is quite possible that they are predisposed. Children who have suffered with convulsions in early life frequently have epilepsy later in life. This has led some authors to believe that convulsions and epilepsy are as cause and effect.

Undoubtedly many cases of this kind exist. Statistics prove, however, that one-half of all eclamptic children have no further nervous diseases in later life. Hence, *we must not claim that if an infant suffers with eclampsia it must necessarily become an epileptic.*

An injury to the head, fright, or sunstroke may possibly cause this disease. Some authors state that epileptic convulsions are intimately associated with adenoid vegetations, phimosis, and masturbation. Foreign bodies in the nose, throat, and ear may occasionally be predisposing factors. Other writers believe that menstrual disorders will provoke epilepsy.

"The etiology of idiopathic epilepsy is mainly to be sought in alcoholism in the parents, which induces a defective organization of the brain structures in the descendants. Inherited syphilis is a less frequent factor. The signs of inheritance are chiefly seen in the departure from the normal in the skull formation, microcephalus, macrocephalus, as well as asymmetries of the skull and facial bones. Flatness of the cranial arch is found in a considerable proportion of epileptics, particularly among the males. Signs of rickets are especially frequent in epileptic children. Aronsohn, in a study of heredity among 508 epileptics, found a history of neuropathic disease in the parents in 32 per cent. Females showed a stronger tendency to inherit the disease than males, 33 per cent. against 30 per cent. The disposition on the part of the mother to transmit epilepsy is greater than that of the father (39 1/2 against 29 per cent. of inherited cases). Where both parents were hereditarily burdened, 63 per cent. of the children inherited the disease. In 82 per cent. of the inherited cases, the disease began before the twentieth year of life. Wildermuth, in 145 cases of early epilepsy, found inherited tendencies in 49 per cent., drunkenness on the part of the parents contributing nearly one-half (21 per cent.) of the examples. Traumatism in early life furnishes a small number of cases of epilepsy. Among 210 patients assembled by Wildermuth antecedent injury to the head had occurred eight times. In the majority of the traumatic cases, the seizures followed the injury within a few days or weeks, seldom after months. Epileptiform seizures and their sequelæ are sometimes found where there has been antecedent meningitis, porencephalia, or cerebral hæmorrhage in infancy; they may also result from acute infectious processes, but in these instances they are to be regarded not as belonging to true epilepsy, but as the symptomatic expression of a coarse, irritative cerebral lesion" (Berkley).

Pathology.—Gowers states that the disease is probably located in the gray matter of the cortex. It should be regarded as a muscular spasm, the result of the sudden overaction or discharge of the nerve cells.[1]

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[1] **Gowers.** Diseases of the Nervous System, Amer. Ed., 1888.

Of 1450 cases of epilepsy studied by this same writer, 12 per cent. began during the first three years of life, and 46 per cent. between the tenth and twentieth years.

An interesting point was brought out by Herter and Smith,[1] who studied 238 specimens of urine taken from 31 epileptics.

They noticed that in 72 of these observations there was excessive intestinal putrefaction, as shown by the presence of ethereal sulphates in the urine *just before the occurrence of the spasm.* These authors were warranted, therefore, in their conclusion, that there is a distinct association between the intestinal poisoning and the epileptic seizures. We can readily see that the treatment of any case of epilepsy must be followed along the lines just described.

Symptoms.—There are two kinds of attacks usually met with: first, the grand mal; second, the petit mal.

Grand Mal Form.—The attack may come on gradually or it may be sudden. Children old enough to complain frequently have a warning of the attack known as the aura. This aura consists in a series of symptoms, such as a twitch in the leg or the face, constituting a local spasm described by some authors as a "motor aura." Then again there may be abnormal sensations, such as a tingling or numbness in any part of the body, until the patient suddenly falls with the spasm. There may be an unusual tremor or a shivering sensation, and the patient may fall to the floor with a sharp cry, having the jaw set and all the muscles of the body *in tonic spasm.* The eyeballs are usually rolled upward. After a few seconds, during which the skin is cyanotic, a second stage follows in which there are *clonic spasms.* There may be involuntary spasms of the bladder and bowel. In the clonic stage the muscles frequently contract and relax violently. Not infrequently the tongue is apt to be caught between the teeth and is bitten. There may be frothing at the mouth. Very marked rigidity of the sterno-cleido-mastoid. The head may be thrown backward or it may be twisted to one side. The extremities may relax and then become rigid again, and the cyanosis gradually disappears. Children usually fall into a deep sleep as though exhausted after the end of the clonic stage. This sleep lasts hours at times. Children old enough to describe symptoms will state that they have no knowledge of what has happened. They awake just as children do after a deep chloroform narcosis.

Petit Mal Form.—This is a milder type of the condition above described. The attacks, instead of lasting minutes and hours, usually last but a few seconds. The child does not fall, but may sit quietly during the seizure until it passes off.

An aura is absent in this condition. The attacks not infrequently happen several times a day. They may also occur at night. In some children we have both varieties.

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[1] New York Medical Journal, August and September, 1892.

Differential Diagnosis.—Epilepsy is frequently confounded with hysteria. In hysteria there is partial consciousness. In epilepsy there is a loss of consciousness. The biting of the tongue and symptoms, such as the nocturnal appearance of the attacks, will aid in establishing the diagnosis. There is usually a dilatation of the pupils.

An epileptic may have an attack in inopportune places, such as the street or on a hot stove, whereas a case of hysteria usually selects a place indoors, entirely out of danger.

Prognosis and Course.—This disease does not follow a regular course. The usual interval between seizures in the very beginning may be months. Regular intervals of epileptic attacks may be every two or four weeks. In some severe cases seen by me the attacks came on every day. It is not unusual for epileptic seizures to come at night only. When such is the case the diagnosis is very difficult.

The outcome depends on the condition of the patient. A child may be seized with an attack while on the street and be killed by an accident. Instances are on record where epileptics have fallen in the water and were asphyxiated during the spasm. Traumatic epilepsy will occasionally be cured by surgery. Generally speaking, the cases of epilepsy seen by me did not do well with surgical treatment.

Treatment.—A case of this kind should never be left alone, owing to the danger of accident during the epileptic seizure. If a cause exists, such as adenoid vegetations or phimosis, the same should be radically treated. I have previously mentioned the results of Herter's examinations of the urine; thus we find that the products of indigestion are usually found in epilepsy.

Dietetic Treatment.—Arguing from this point of view, the stomach and bowels must not only be constantly supervised, but the lightest kind of nutrition that will yield strength should be ordered. The action of the bowels must be frequent. The slightest constipation should not be permitted.

Cereals, vegetables, and fruits, in fact, the lightest kind of dairy products, should be ordered. Meat and similar stimulating nutrition should be enjoined. Water and liquids should be freely given. Neither alcohol, tea, nor coffee should be allowed.

Hygienic Treatment.—Children so afflicted should be kept out of doors as much as possible. They should not attend school. They should have cheerful surroundings and avoid all useless excitement. They should be given a bath daily and a proper amount of sleep.

Drug Treatment.—Sodium bromide seems to be the drug *par excellence* in the treatment of this disease. Children can take as large if not larger doses of bromide than adults. I have frequently given 10 grains of bromide of soda to a child 1 year old, and repeated the same several times a day.

We must study the tolerance of every child by carefully increasing the dose until the physiological effect of the same is produced. Seguin advises giving large doses early in the morning, small doses during the day, and large doses at night. The reason for the *large dose at night* is the frequency with which the attacks appear in the night. Belladonna is advised by some authors. Chloral hydrate is frequently useful when combined with the bromides. I sometimes use arsenic alone when the bromides cause acne.

Restorative treatment should be combined with this anti-spasmodic treatment. The system should be strengthened by giving iron and strychnine. The use of malt extracts and codliver-oil will be found beneficial. Regarding the surgical treatment of epilepsy Sachs, quoted by Holt, says:—

"In a case due to a traumatic or organic lesion an early operation may prevent the development of cerebral sclerosis. If an early operation is not done, the occurrence of epilepsy is a warning that secondary sclerosis has been established and an operation may prevent it from increasing. Operation must include the removal of the diseased area; here, if all other parts are normal, a cure may result. Under favorable conditions a few cases of epilepsy may be cured by surgery and many more improved."

B. Sachs and A. Gerster[1] give the following summary: An operation is permissible in traumatic epilepsy when the case is not over 1 or 2 years old. When there is a depression of bone, the operation is indicated at a later period, but should not be delayed. Trephining alone is sometimes sufficient. If the disease is of short duration, a part of the cortex may be incised. The complication of infantile cerebral paralysis, if the case be recent, is no contraindication to the operation. It must not be performed in epilepsy of long duration.

Acute Myelitis.

This condition consists in a diffuse inflammation resulting in destruction of spinal elements and the softening of the cord.

Etiology.—It is not a rare condition, but is most frequently seen as a complication of the infectious diseases. Chilling of the surface of the body seems to favor the development of this condition. Some authors state that it follows metallic or other chemical poisonings. It is frequently associated with spinal trouble, such as Pott's disease. Injury is frequently given as a cause, *but syphilis is the most frequent cause.*

Pathology.—*Macroscopical:* The cord is seen thickened and surrounded by hyperæmic meninges. The substance of the cord is much softer than normal and sometimes resembles pus. Frequently small punctate hæmorrhages and even larger extravasations of blood can be seen microscopically. In severe disintegration of the cord, the microscopical findings are useless. It is in the mildest forms that pathological changes can best be studied. In the dilated blood-vessels we find leucocytes and granules of myelin. Corpora amylacea are frequently seen.

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[1] American Journal Medical Science, October, 1896.

Symptoms and Diagnosis.—The symptoms depend on the portion of the cord tissue involved, and on the severity of the process. In syphilis we have a slowly developing condition weeks and months before myelitis symptoms pointing to this condition can be noticed. If children can complain they describe a sense of weight in the legs which gradually increases so that in a few days the limbs are entirely palsied. Convulsions and delirium have frequently been noted. When the reflexes are anatomically related to the affected segments they disappear, and below that level they are increased; after a few days, if the cord has been entirely destroyed at the inflammatory focus, the reflexes are entirely abolished (Church). "Provided the posterior roots and meninges are involved, pain in the back and limbs is a prominent symptom, but rarely is of an excruciating character at the onset. At the upper level of the inflammation some pain is the rule, which gives rise to a band or girdle sensation and a zone of hyperæsthesia about the abdomen or chest. This sign, with the paralysis, definitely localizes the upper limit of the lesion, but if it be in the lower cervical region this sensation passes down the arms and is not so sharply defined. Lesions in the cervical region are also marked by implication of the cilio-spinal center, with consequent dilatation of the pupil. Continuous priapism is then, too, a usual occurrence, and the intercostal muscles and heart may be affected. Below the lesion, and depending upon its intensity, there are variations in sensibility to all forms of stimulation, from slight blunting to the usual complete anæsthesia. Sensations of drowsiness and aching in the paralyzed and anæsthetic limbs are sometimes mentioned; and cramps and drawing up of the limbs frequently occur early, and later are the rule. Distinct muscular atrophy related to the portion of the cord affected takes place, but in the trunk it is not readily discernible. The paralyzed limbs during the first few days are abnormally warm, but soon present a subnormal temperature; sluggish circulation and emaciation ensue, with œdema of the feet and legs if the limbs are left any length of time in a pendent position. If the lesion is low down, the atrophy is a marked feature and the reaction of degeneration is present. Under the influence of pressure, bed-sores form on prominent portions of the body and limbs, and this very early. In some cases within the first week immense sphacelization may take place over the sacrum, which cannot be explained by pressure and the moisture from the urine, but implies a dystrophic condition of cord origin. Trophic symptoms (bed-sores) are especially liable to occur when the lumbar cord is the seat of the disease.

Prognosis and Course.—The course of the disease is chronic. The condition varies but little. The symptoms get worse and worse until death ends the trouble. From a few weeks to a few months may terminate the disease.

At times if it is associated with or dependent on Pott's disease, improvement may be expected. Sometimes myelitis is caused by syphilis either in its active form or due to a syphilitic neoplasm. It is rare in such conditions to effect a cure.

Treatment.—If specific conditions such as syphilis exist, then antiluetic treatment is required. Iodide of sodium can be given in very large doses, 5 to 50 grains per day. The general indications, such as attention to the stomach and bowels, must be met and stimulated if required. It is important to feed a patient in this condition with very nutritious food. Counter-irritation over the spine is advisable. For this purpose tincture of iodine or mustard will be useful. I insist on absolute rest in bed (water bed if possible) and in frequent change of position.

CHRONIC MYELITIS.

This condition is usually the continuation or the prolongation of acute softening of the cord. It is here that we find bed-sores as well as disturbances of the bladder and bowels.

Treatment.—The treatment consists in what has been previously advised in the acute condition. Life can only be prolonged by giving tone to the system with proper food.

MALFORMATION OF THE SPINAL CORD (SPINA BIFIDA).

The most frequent malformation seen is spina bifida. It affects the vertebral canal and ends in a protrusion of a small or large soft tumor filled with serum. This serum is a clear yellowish liquid similar to cerebro-spinal fluid. We are indebted to Humphrey[1] for an accurate description of this lesion. He says: "Spina bifida is due to an early failure in development, in most cases before the cord is segmented from the epiblastic layer from which it is developed. Hence, it remains adherent to the epiblastic covering, and the structures which should be formed between the cord and the skin are developed. For this reason we have in the wall of the sac a fusion of the elements of the cord, nerves, meninges, vertebral arches, muscles, and integument. If the error in development occurs later, the cord and nerves may be attached to the sac, but not intimately fused with it; in still other cases the cord does not enter the sac at all. The malformations may occur before the central canal is closed, or, if closed, it may reopen from the accumulation of fluid. It is probable that the accumulation of fluid first occurs, and that this prevents the union of the parts of the vertebral arches.

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[1] Lancet, March 28, 1885.

"Although the tumor is generally associated with a bifid spine, this is not necessarily the case. The protrusion may take place through the intervertebral notch or foramen, or there may be a fissure of the bodies of the vertebræ, and an anterior tumor projecting into the cavity of the thorax, abdomen, or pelvis, spina bifida occulta. The principal anatomical varieties are meningocele, meningo-myelocele, and syringo-myelocele."

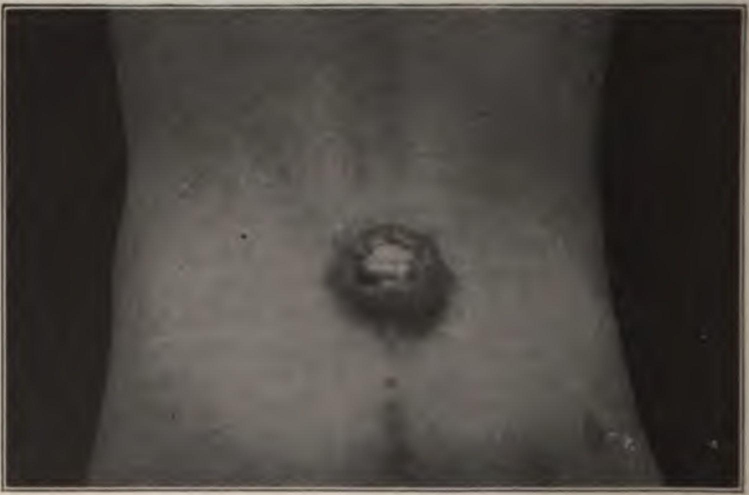

Fig. 258. —Case of Spina Bifida. Spontaneous cure. Male child, 6 years old. Now suffers with paralysis of both legs. Well nourished. No evidence of hydrocephalus. (Original.)

The following case of spina bifida occurred in my private practice. A boy, 6 years old, was brought to me with a history of having a very large growth in the lumbar region. The sac burst spontaneously. Since that time the boy has a double paralysis, and also suffers with incontinence of urine and fæces. He was brought to me for the treatment of the paralysis. The general condition was good and he appeared well nourished. There was no evidence of hydrocephalus.

Treatment.—The treatment of spina bifida is surgical. I have seen a number of successful cases.

HEREDITARY ATAXY (FRIEDREICH'S DISEASE).[1]

This condition is caused by a degeneration of the posterior columns of the spinal cord. As a rule several members of the same family are affected.

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[1] I am indebted to Williams's excellent monograph for some points in this article.

Etiology.—This disease is usually seen at or about the period of puberty. Measles, scarlet fever, or any other acute infectious disease may precede the development of this condition.

Pathology.—The lesions seen are: "Sclerosis in the posterior columns (columns of Goll in their whole extent, and columns of Burdach in their upper part), in the direct cerebellar tract extending laterally into the column of Gowers, in the lateral columns (crossed pyramidal tract), in the gray matter (columns of Clarke, and posterior horns). In some cases dilatation of the central canal has been observed."

Symptoms and Diagnosis.—The motor system shows the most characteristic symptoms. The patient stands with the feet far apart. The body sways and there is an unsteadiness while trying to maintain the equilibrium. The gait resembles that of an alcoholic intoxication. A tremor of the hands and head and choreiform movements affect the same parts. Paralysis and emaciation may be present. The tendon reflexes are absent as a rule, but their presence does not speak against the diagnosis in the early stage of the disease. The eyes show nystagmus. There is no optic atrophy. There is vertigo. The speech is slow. The intellect seems impaired. There is a peculiar clubbing of the feet. The foot is short. The toes are overextended, the instep high and hollow. The Babinski phenomena or hyperextension of the big toe may be the first symptom of this condition.

The prognosis is grave. The disease lasts years.

Treatment.—The disease runs its course, although electricity and restorative treatment plus massage may be tried. The disease usually ends fatally.

INFANTILE SPINAL PARALYSIS (POLIOMYELITIS).

This disease is characterized by a sudden onset of fever, then paralysis, usually followed by muscular atrophy and imperfect bone development, sometimes by deformity.

Etiology.—The majority of cases occur before the tenth year. Some authors state that three-fifths are seen before the fourth year. The most susceptible period seems to be during the last six months of the first year. The majority of cases occur in summer (Sachs).

Most cases occurring in hot weather begin with fever, diarrhœa, and vomiting. There seems to be reason to believe that the bacterial infection in the intestine generates a toxæmia which may be an etiological factor.

Pathology.—We are indebted to Provost and Goldscheider for a complete study of the pathology of this condition. The latter believes that "a condition of irritation is present in the walls of the blood-vessels of the cord leading to their dilatation and to the proliferation of their endothelial elements. Later degenerative changes occur in the ganglion cells, as well as in the new fibers appearing in the vicinity of the altered blood-vessels."

The clinical data show this to be due to an invasion of bacteria, although it has not yet been proven. The fact that the disease appears in epidemics points to the possibility of bacterial invasion. The inflammatory process is limited to the anterior horns or extends to the medulla and pons. The inflammatory process is interstitial, not parenchymatous. "The muscles become atrophied. The fibers diminish in size, possibly disappearing, their places being filled by adipose tissue."

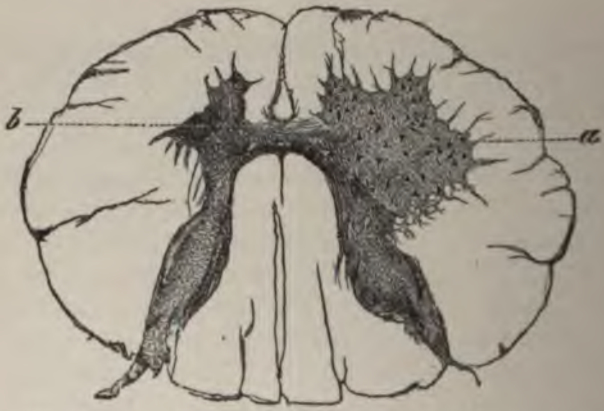


Fig. 259.—Poliomyelitis. Sclerosis and cicatricial atrophy of the left anterior horn of the fourth cervical nerve after acute anterior poliomyelitis. *(a)* Normal anterior horn with ganglion cells. *(b)* atrophic anterior horn. (Ziegler.)

TABLE No. 102.

ACUTE SPINAL PALSY.	ACUTE CEREBRAL PALSY.
Onset sudden, with fever, coma, and convulsions. Convulsions rarely repeated after first few days.	Onset sudden, with fever, coma, and convulsions. Convulsions apt to be repeated.
Paralysis flaccid, associated with atrophy. Marked trophic changes. Deformity without contractures.	Paralysis spastic, no atrophy, no marked trophic changes. Associated with rigidity and contractures.
Paralysis widely distributed, possibly involving all extremities, or narrowly limited to one member or even a single group of muscles.	Paralysis generally hæmiplegic, sometimes diplegic or paraplegic. Monoplegia rare.
Electric reactions altered (R. D.).	Electric reaction normal.
Deep reflexes diminished or lost.	Deep reflexes exaggerated.
Intellect never permanently involved; no epilepsy.	Intellect often involved; epilepsy frequent (Sachs).

Symptoms.—Acute poliomyelitis usually appears as any other infectious disease. Children usually have fever reaching 102° or 103° F., followed by a sudden paralysis; sometimes vomiting and convulsions may also be present. The reflexes are greatly diminished or entirely absent. The emaciation occurs very early and the part affected is limp. The muscles lose their tone and are soft and flabby. The surface temperature is cold. Shortening takes place. The electric reaction of the paralyzed muscles and nerves shows "the reaction of degeneration," the anodal closure contraction being equal to or greater than the cathodal closure contraction.

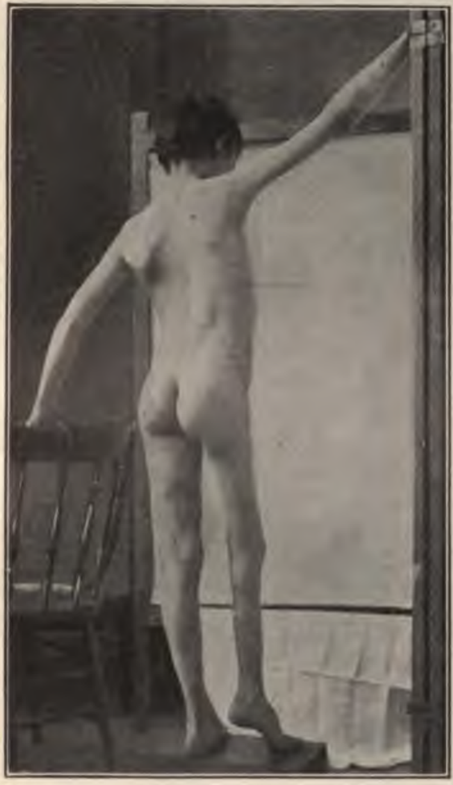


Fig. 260.—Infantile Paralysis, with Atrophy and Impaired Growth of the Right Leg, and Drop-foot; Four Years After the Onset. Note atrophy on affected side. (Case of Dr. M. Allan Starr.)

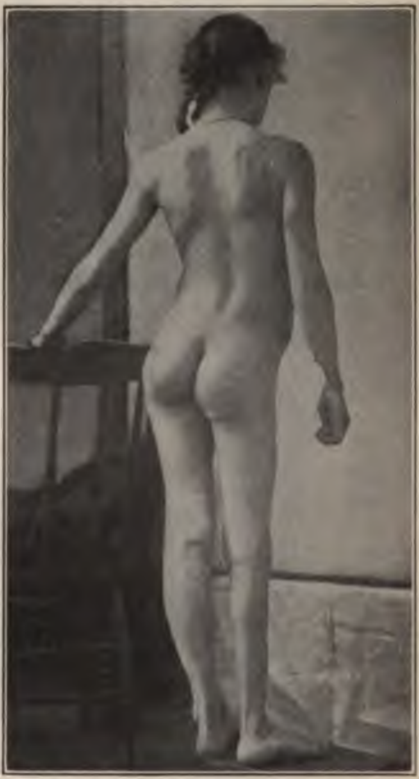


Fig. 261.—Infantile Paralysis, with Atrophy of the Right Leg. The curvature of the spine is secondary to the shortening of the leg. (Case of Dr. M. Allan Starr.)

According to Sachs the reaction to the faradic current is lost at once, but to galvanism it remains or is increased for some time and then is lost, except that it may appear to very strong currents. There may be tenderness along the affected nerve and pain in the muscles during the acute stage. The bladder and rectum are usually not involved. The brain is not affected, so that this condition *per se* does not give rise to mental derangement.

Diagnosis.—This disease usually follows fever. At times it is a one day's fever followed by paralysis. There is "a stationary stage lasting one to six weeks. Then a period of improvement" lasting about six to twelve months, and lastly, "a stage of permanent disability," lasting throughout life.

The initial fever is sometimes followed by pain in the limbs and the condition mistaken for rheumatism. *In no other disease is the response to the faradic current absent as early as in this condition.* In diphtheritic palsy the previous history will assist in clearing up the doubtful diagnosis. Atrophy of the muscles occurs very early and is an important diagnostic guide.

Prognosis.—It is difficult to state what will be the outcome of a case of this kind. I have seen some very severe cases entirely recover. The severity of the beginning of an attack is no guide as to its outcome. Some mild cases may leave permanent deformities; as a rule, however, some muscles remain permanently paralyzed. The reaction of the muscles with the faradic current should be the guide in estimating the outcome of any case.

The following case will illustrate this condition as seen by me at the children's department of a large outdoor service:—

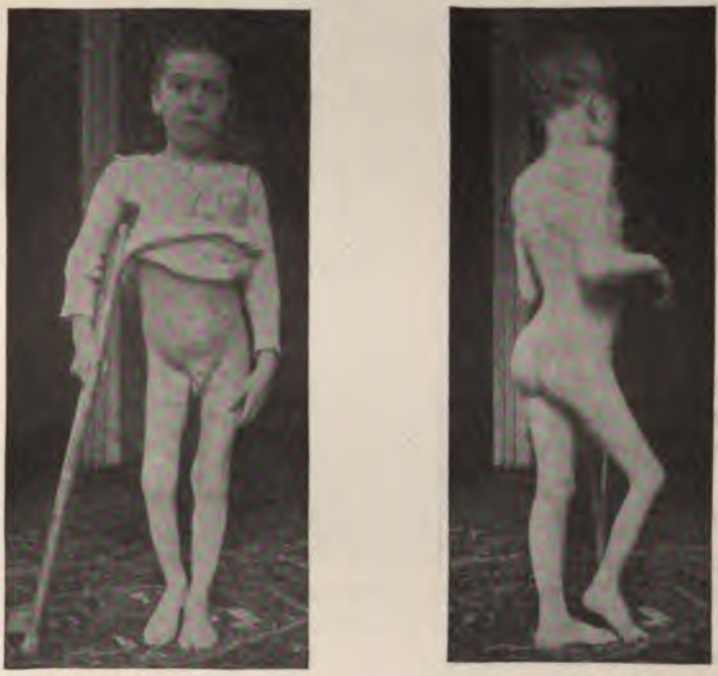
Baby Romeo, eleven months old, male infant, was referred to me by Dr. E. D. Lederman. The child had measles when six months old. This was followed by bronchitis. Was breast-fed three months and since then has received equal parts of cows' milk and water. Dentition has been normal. He has six teeth. Has had an occasional dyspeptic attack. The mother states, that about four months ago the child had fever lasting one day; on the following morning the legs were paralyzed. This paralysis gradually improved and to-day is confined to the right side only. There is a distinct anæsthesia over the foot, which is gradually less toward the thigh. The patellar reflex is absent on the right side. There is no ankle clonus. The plantar reflex is very slightly present. The foot is very cold, there is marked atrophy of the limb noticeable. A hæmic murmur is heard with the first heart sound and the same is also heard in the vessels of the neck. The diagnosis of poliomyelitis was made. Massage and galvanic electricity were ordered. Strychnine, $^{1}/_{100}$ grain, also baths consisting of 250 grams ferri sulphas, crude, every third night followed by brisk friction was prescribed. An antiscorbutic diet was also prescribed.

Treatment.—The strictest attention should be given to the hygienic surroundings of the patient. A tepid sponge bath should be ordered every day, the water containing some sea salt. This bath should be followed by massage and passive movements. A very gentle galvanic current should be used. It should be strong enough to produce muscular contraction, with due respect to the child's feelings. Harsh manipulation or strong currents of electricity should be avoided.

Next in importance is tonic treatment; for this purpose iron, cod-liver-oil, or maltine can be given several times a day. Large quantities of butter and cream, and all dairy products are valuable restoratives. Strychnine is very valuable, but should not be given until the acute condition is over.

It is self-understood that massage to be effectual must be given by a trained nurse or one skilled in the art. Rubbing the affected limbs is useless compared with proper massage.

Electricity should be cautiously administered and its effect carefully noted; under no consideration should we permit the family to get a battery and apply electricity at random.



Front View. Side View.

Fig. 262.—Infantile Paralysis. Note drop-foot and drop-wrist.[1]

Massage properly used can sometimes prevent the contractions and deformities that frequently are associated with this form of paralysis. *Orthopædic treatment* should never be neglected in these cases. The well-known results following a tenotomy should be borne in mind. The intelligent physician will remember that systemic conditions, such as syphilis, tuberculosis, or rickets, require special treatment, in addition to the treatment outlined above. I have seen splendid results follow orthopædic treatment, and the reverse is true when children are neglected and left to Nature.

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[1] I am indebted to Dr. Dexter Ashley for the above illustrations.

A. B., boy, 7 years old. Anterior poliomyelitis at 1 year of age. Mother says the limb was quite useless for a long time. Became very much deformed by contractions. Has been treated by massage and electricity. Examination: Right limb abducted 10°, flexed to 120°: knee flexed to 170°. Foot in position of slight calcaneo-cavus: marked atrophy, the right limb being 22 ½ inches and the left limb 24 inches long: muscles in evidence at the thigh: tensor vagina femoris much contracted, with which he abducts and flexes the leg; a portion of the abductor longus and gracilis intact but weak, hamstrings weak but holding the knee in contraction; leg muscles, extensor longus digitorum and peroneii.

Treatment suggested, tenotomy of hip contraction under the anterior superior spine, stretching of knee contracture, applying plaster of Paris until all tendency to assume deformity is overcome, when a brace will be applied.

Hydrocephalus.

This is an accumulation of serum in the head.

External Hydrocephalus.—When the effusion is between the dura mater and the pia.

Internal Hydrocephalus.—When the lesion is in the ventricles of the brain. The latter condition is most commonly seen.

Acute Hydrocephalus.

This condition usually follows basilar meningitis. In acute hydrocephalus the effusion is not large. Some authors state that no more than three or four ounces of serum are present.

Chronic Internal Hydrocephalus (Water on the Brain).

This condition must not be confounded with tubercular meningitis.

Etiology.—The cause of primary or secondary internal hydrocephalus is very difficult to describe. In some instances syphilis has been given as the causative factor. An interesting paper has appeared by D'Astros[1] who describes 12 cases in which hydrocephalus was associated with syphilitic lesions, so that the condition was congenital. By some, chronic hydrocephalus is believed to be due to tuberculosis.

Pathology.—"The changes in the brain result from the gradual accumulation of fluid in the ventricles. The septum lucidum is usually broken down, and all the avenues of communication between the ventricular cavities are greatly enlarged. The continuous distention results in a gradual thinning of the brain substance which forms the ventricular walls; often these are found only one-fourth of an inch in thickness, or even less than this, the cortex being a mere shell."

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[1] Revue Mensuelle des Maladies de l' Enfance, Chapter IX, pp. 481 and 543.

The brain appears anæmic, so that the gray and white substances resemble each other. The bones of the skull show the lesions very plainly. The sutures are separated in some cases. Where premature ossification has taken place, the head instead of being very large, is very small. This is called a microcephalic condition. Sometimes spina bifida is associated with this condition.

Symptoms.—The first symptoms that attract attention are, that the head is increasing in size; that it seems very heavy; that the child appears stupid; that it does not notice things, but stares continuously. The forehead is very high, the fontanel distended and bulging. On palpating, the soft fluctuating liquid can be felt. The sutures are very wide apart. The pupils are usually enlarged, sometimes contracted. Convulsions are frequently present. While the head enlarges the body emaciates.

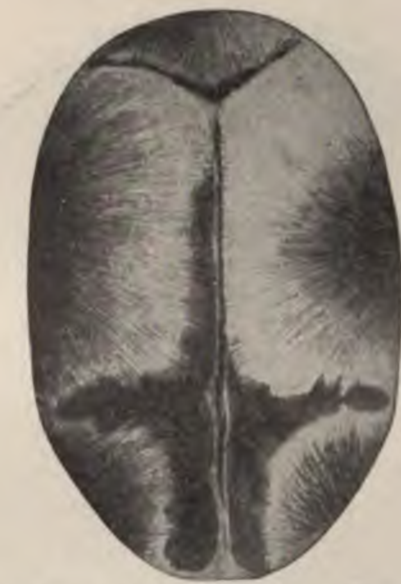

Fig. 263.—Hydrocephalic calvarium (or skull-cap), widely gaping fontanels and sutures. One-half natural size. (Langerhans.)

Prognosis and Course.—This disease usually terminates fatally about the seventh year. In rare instances the condition may extend through life with impaired mental faculties due to the brain trouble. Cases that have been reported cured should be viewed with suspicion.

A female, eleven months old, was brought to my clinic with the following history: The infant cannot hold its head. The head must be supported or it will roll from side to side. The infant is backward, does not speak, and is not bright. Comparing this child with the other children of the family, she appears idiotic. Dentition has been delayed. She was breast-fed and was still nursing. The mother noticed the very large head when the infant was three months old.

Family History.—Father was alcoholic. Mother was healthy. Two children were living and in apparent good health. Two children died of summer complaint and marasmus.

Condition of the Head.—A bulging, distended fontanel; the sutures both anterior and posterior were at least one-half inch apart. There is exophthalmos. The forehead is very high and projecting. The superficial veins of the scalp are thickened and distended. There is a prominence at the root of the nose. The muscles of the body are very flabby. The case was referred for aspiration to Dr. Carl Beck. More than a pint of liquid was aspirated through the anterior fontanel.

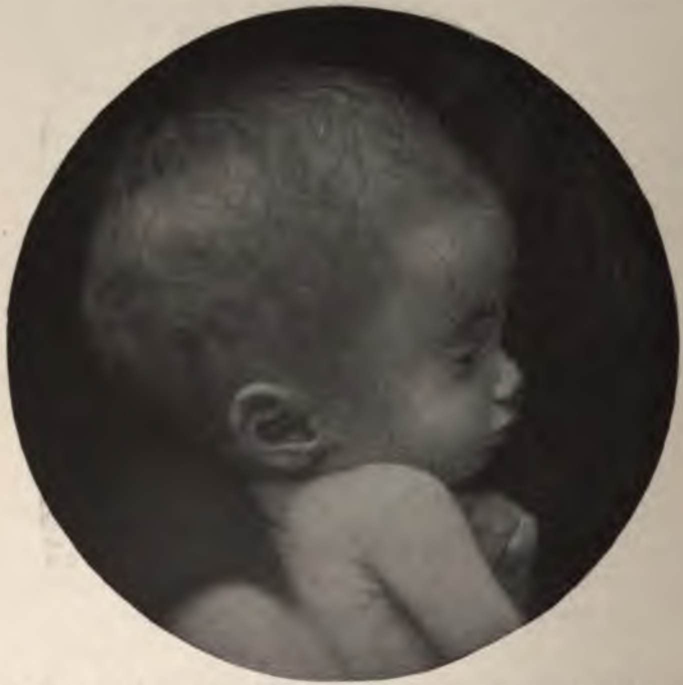

Fig. 264.—Case of Chronic Hydrocephalus, Illustrating Globular Head, Enlarged Superficial Veins, Fullness of Fontanel. Child eleven months old. (Original.)

Treatment.—Aspiration has been tried by many, with no apparent benefit. I have never seen a good result follow the aspiration of the liquid, because the fluid returns very rapidly, so that nothing is gained by the operation.

Blistering, counter-irritation, strapping, and lumbar puncture have been tried by me with no apparent success. Iodoform collodion has been recommended by some.

In a case seen in consultation with Dr. L. Harris, of this city, convulsions were relieved by lumbar puncture.

Mercurial inunctions and large doses of iodide have been tried. If syphilis is the cause, then some benefit may be expected from specific treatment.

MENINGOCELE.

When there is defective ossification in the bones of the skull and some part of the membranes of the brain protrudes, it is called a meningocele. Some writers believe it is caused by an intra-uterine hydrocephalus. These tumors generally contain cerebro-spinal fluid in the bag of membrane. When pressure is exerted over the swelling, the liquid will be emptied into the brain. Sometimes cerebral symptoms will result from this manifestation.

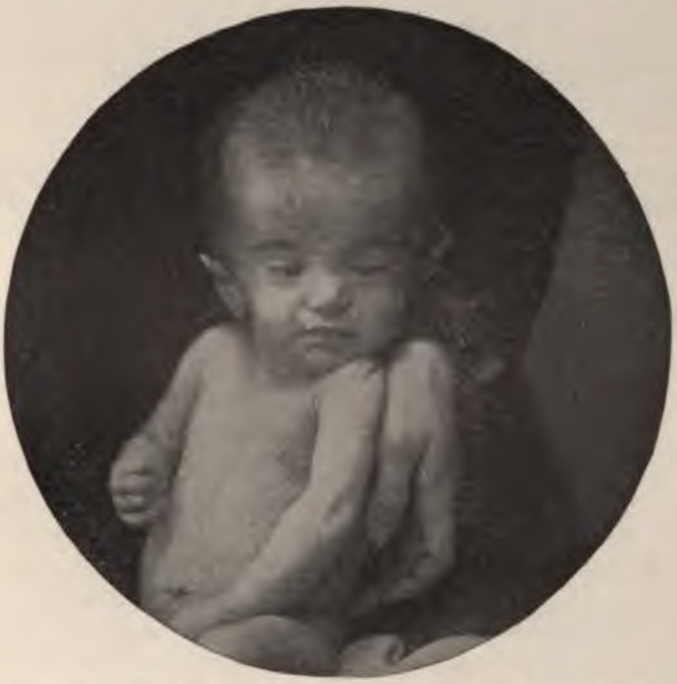

Fig. 265.—Same Case. Note the peculiar condition of the eyes, and the fullness of the head, especially in the region of the fontanel. (Original.)

ENCEPHALOCELE (CEREBRAL HERNIA).

In this condition there is a protrusion of the brain substance in addition to the membrane. This protrusion takes place through the frontal and occipital bones. It is usually a congenital deformity. If the tumor contains a portion of a dilated ventricle and is filled with cerebro-spinal fluid, it is called a hydro-encephalocele or hydro-encephalo-meningocele.

A case of this kind was seen by me some time ago in which the tumor protruded through the occipital bone. It was a congenital deformity. Distinct pulsation could be felt. The tumor increased in size when the child cried. Convulsions resulted from forcibly pushing the tumor into the cranial cavity.

Treatment.—The injection of 1 drachm of Morton's fluid after aspiration of some of the liquid contents may be tried. Morton's fluid:—

℞ Kali iodide	30 grains
Iodine pure	10 grains
Glycerine	1 ounce

M. Inject 1 drachm after each aspiration.

If no improvement is noted after some time, surgical treatment should be tried.

Cyclops.

This is a very rare condition and consists of the child having but one orbit, which is situated in the middle of the forehead at the root of the nose.

Porencephaly.

This consists usually of a defective development, leaving a hole in the brain. It is a congenital disease and may be located in any portion of the brain.

CHAPTER IV.

TUBERCULAR MENINGITIS (BASILAR MENINGITIS).

THIS is usually a secondary condition. It is not a primary disease of the meninges. In infants, tubercular meningitis usually follows bone tuberculosis, tuberculosis of the lymph nodes or joints, and not infrequently a tubercular otitis may extend and involve the meninges.

Etiology.—The association of adenoid vegetation and the probable entrance of the tubercle bacillus through the lymph channels of the neck is the most probable means of infection.[1] (See article on "Acute Tuberculosis.")

Bacteriology.—There is no question about the association of the tubercle bacillus with this infection. It can be found in the spinal fluid withdrawn by a lumbar puncture. Other pathogenic bacteria may also be found. In one case reported by me we found the diplococcus intracellularis in addition to the tubercle bacillus.

Pathology.—The chief pathological condition is a growth of miliary tubercles. Associated with these we frequently find tubercular nodules of variable size, and in almost every case they are the products of ordinary inflammation of the pia mater—lymph or pus—together with an accumulation of fluid in the lateral ventricles of the brain. Holt says: "Frequently there are tubercles in the pia mater of the upper portion of the cord. The miliary tubercles appear as small gray or white granules, situated along the vessels of the pia mater. When few in number they are usually located at the base, especially along the Sylvian fissures and in the interpeduncular space. When numerous, they are most abundant at the base, but are also seen scattered over the convexity in small groups. In about half of my autopsies they have been limited to the base, and in no case were they seen exclusively at the convexity. Tubercles are often found in the choroid coat of the eye. The amount of lymph and pus present is rarely great, and never equal to that seen in simple acute meningitis. It is often a matter of surprise at autopsies to find the lesions so few, after very marked symptoms. The inflammatory products are most abundant at the base. In addition to the patches of greenish-yellow lymph, there are adhesions between the lobes of the brain and thickening of the pia. In cases which have lasted for several weeks, the pia mater in places is often very much thickened.

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[1] This view is maintained by W. Freudenthal, of New York.

owing to cell infiltration and the production of new connective tissue, and it is studded with miliary tubercles, sometimes with small yellow tuberculous nodules; frequently there is arteritis, which is sometimes obliterating.

"In the most acute cases the brain substance immediately beneath the pia is intensely congested, slightly softened, and shows under the microscope a superficial encephalitis. The lateral ventricles are usually distended with clear serum, sometimes with serum containing flocculi of lymph or pus; the amount present varies from one to four ounces in each ventricle, being always greater in the subacute cases. The walls of the ventricles may be softened. The distention of the ventricles leads to flattening of the convolutions from pressure against the skull, to bulging of the fontanel, and sometimes to separation of the sutures, if they are not completely ossified."

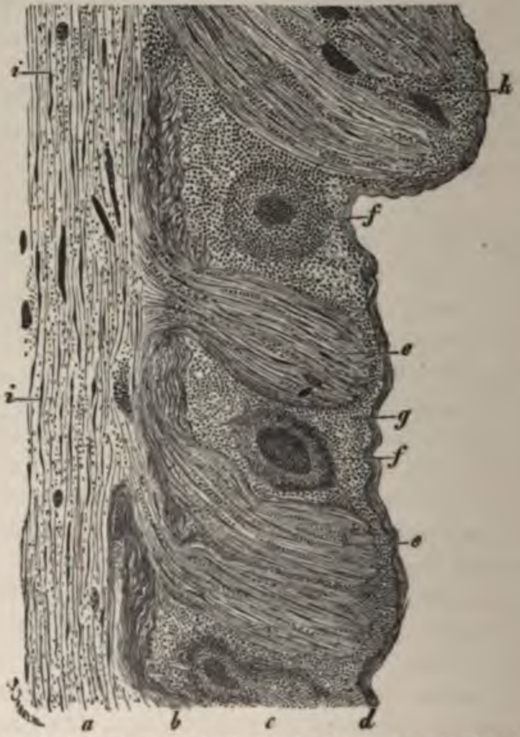

Fig. 266.—Tuberculous Spinal Meningitis. Longitudinal Section of Spinal Cord and Posterior Roots. (*a*) Spinal cord; (*b*) pia mater; (*c*) subarachnoidal space; (*d*) arachnoid; (*e*) posterior roots, cellular infiltration and containing isolated swollen axis cylinders; (*f*) vessel with cellular infiltration and proliferated wall; (*g*) cellular exudate in subarachnoidal space; (*i*) swollen axis cylinder. X45. (Ziegler.)

Tuberculous nodules varying in size from a small pea to a walnut are frequently seen associated with meningitis in older children, but not so often in infants. These nodules may be connected with the meninges, or they may be situated within the brain substance, usually in the cerebellum. The larger ones are classed as brain tumors. Inflammatory products are rarely found in the spinal canal.

Course.—The course of tubercular meningitis is from three to ten days, although the symptoms may last from four to eight weeks, or even longer.

Child B. W., 5 years old. Father a physician and healthy. Mother healthy. Had just returned from the country in apparent good health. Was sent to school and seemed bright mentally and physically. Was a well-nourished child. Had had no previous illness excepting a disordered stomach. The first symptom of her present illness was headache. Had a coated tongue, loss of appetite and a slight rise of temperature, from 100° to 101° F. The temperature was very characteristic. (See chart.) The parents suspected a slight dyspeptic attack and gave her a laxative. Her diet was also corrected. In spite of cleansing the stomach and bowels, the headache persisted and reached such an acute stage that the child cried and moaned continuously, and did not sleep. When I first saw the case the symptoms of an acute gastric catarrh were so evident that nothing further was suspected. The headache persisted in spite of bromides. The child complained of ringing in the ears. Had twitchings of the arms and legs. The bowels assumed a normal color and consistency. An examination of the eyes with the ophthalmoscope was first made by Dr. H. Jarecky and later by Dr. Henry S. Oppenheimer, who found vision good, no choked disk—engorgement of veins only—slight reaction of pupils. No evidence of tubercular disease was found. In the beginning of this illness the symptoms of headache were very prominent. The child appeared quite rational and the diagnosis of supra-orbital neuralgia was made. Dr. George W. Jacoby, who saw the case at my request, early in the disease did not believe that we were dealing with meningitis. Later on, however, the symptoms were positive. Dr. Abraham Jacobi, who saw this case later in consultation, diagnosed meningitis. At his suggestion leeches were applied and they afforded quite some relief. The headache reappeared with renewed vigor and remained incessant throughout the period of illness. Owing to the continued pain it was decided to relieve the intracranial pressure by lumbar puncture. I aspirated 45 cubic centimeters of clear spinal fluid, which was sent to Dr. Billings, of the New York Health Department, for examination. He reported the presence of the tubercle bacillus and the diplococcus. Dr. B. Sachs confirmed the diagnosis of tubercular meningitis.

Strabismus was also present. There was marked facial paralysis. Nausea and vomiting occurred. There were spasms and twitchings, also a hæmiplegic paralysis. There was also a unilateral flush on the cheek and other well-marked evidences of vasomotor disturbances. The child was either soporose, in a semi-stupor, or crying and screaming with pain in the head. A distinct red streak remained when the skin was stroked with the finger nail, the so-called tache cérébrale. The Babinski reflex was also present. There was spastic rigidity of the entire body. The eyes were half open. Respiration was labored, at times—Cheyne-Stokes respiration. The pulse was small and compressible and varied between 80 and 160. The child died of extreme exhaustion and inanition, after suffering about ten days of terrible agony.

Symptoms and Diagnosis.—Very irregular symptoms show themselves in this condition. The clinical picture varies in each and every case. I have never seen two cases that showed exactly the same symptoms. Symptoms of malnutrition, such as emaciation and general weakness, are very evident. Vomiting, projectile in character without nausea, is a common symptom. The temperature is slightly raised in the beginning, but after the first week it usually rises from 100° to 103° F., or even higher. The pulse which sometimes is accelerated is more often slower than normal.

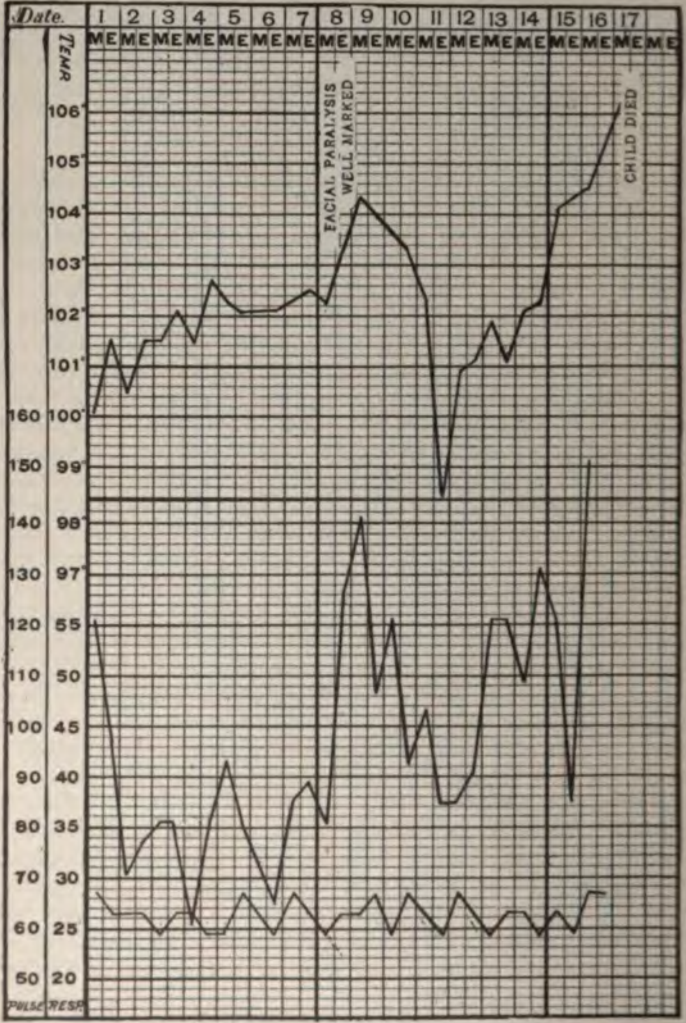

Fig. 267.—Case of Tuberculous Meningitis, well marked, ending fatally. (Original.)

Sometimes it is compressible, and may vary between eighty and one hundred and sixty (80-160) beats per minute. The respirations are increased and irregular in character, labored and sighing, or frequently Cheyne-Stokes in character.

Tache Cérébrale.—The tache cérébrale is frequently present. This is produced by drawing the finger-nail quickly over the skin of the abdomen, arm, or leg, when a sharp bright mark remains for several minutes.

Some symptoms come on very slowly. Intense headache is complained of and is usually supra-orbital in character. In the case referred to in this chapter the symptoms were masked for a number of days. The eyes usually show tubercles in the choroid. In the case reported here, although the eyes were examined by two competent oculists, no evidence of disease could be found. Strabismus as well as facial paralysis are frequently seen as evidence of paralysis. Twitchings are frequently noticed.

The Babinski reflex is very often present.

The child sleeps with its eyes half open. There is marked evidence of vasomotor disturbance, such as unilateral flushes, and spastic rigidity of the entire body is repeatedly seen.

Lumbar puncture will usually show a clear cerebro-spinal fluid. In this fluid the tubercle bacilli can be located. In some cases other pathogenic bacteria; for example, the streptococcus can be found.

The prognosis is bad. I do not know of a single case of distinct tubercular meningitis that finally recovered.

Treatment.—Lumbar puncture should in all cases be performed. For details regarding technique of lumbar puncture see chapter on "Epidemic Cerebro-Spinal Meningitis." Tapping the fourth or fifth ventricle will certainly relieve intra-cranial pressure. No more than 15 to 25 cubic centimeters should be withdrawn at one aspiration. I look upon this as a very valuable diagnostic as well as therapeutic measure. The head should be shaved, and an ice-bag or ice-coil applied continuously. Next in importance several leeches should be applied behind the ears, over the mastoid process of the temporal bone. Cerebral engorgement can also be relieved by applying leeches to the alæ nasi; this will drain the blood through the frontal sinus. Rectal medication should be remembered.

Large doses (5 to 10 grains) of bromide of sodium and sodium iodide should be given until quiet is insured. The bowels should be cleansed by a thorough irrigation with glycerine and water. Iodoform collodion (10 per cent.) can be applied to the scalp, thoroughly, once or twice.

Inunctions with unguentum Credé or mercurial ointment, at the nape of the neck, rubbed into the lymphatics, for at least twenty minutes several times a day, will frequently do some good.

Peptonized milk, whey, soups, broths, zoolak, and buttermilk are indicated. Under no conditions should solid food be administered. If the child is in a coma, rectal feeding must be resorted to. (For details see chapter on "Rectal Feeding.")

EPIDEMIC CEREBRO-SPINAL MENINGITIS (SPOTTED FEVER, OR MALIGNANT PURPURIC FEVER).

Cases of spotted fever frequently appear suddenly, so that an epidemic suggests itself. At other times the disease appears sporadically.

Etiology.—Councilman reports an epidemic of this disorder which prevailed in Boston during the winter of 1896-1897, and the following spring. One hundred and eleven cases were treated in the Boston hospitals during this period. Most of these cases were among young adults. But one case was seen in a child under 1 year of age. The mortality was 68 per cent. Generally only a single case occurred in one family, though in several instances two or even three cases were noted in the same family.

The cause of this disease would be difficult to define. We know that children who have been overworked and underfed are those who are more susceptible to this infection. Not infrequently do we find this disease following as a sequela to other conditions.

Bacteriology.—Weichselbaum, and more recently Jaeger, Councilman, and Osler, studied a diplococcus which is always found in the meningeal exudation during the course of cerebro-spinal meningitis. This germ is sometimes found alone in pure culture, though it is not rare to find it associated with the streptococcus, the pneumococcus, or the bacterium coli.

In 1895 Finkelstein, in an elaborate report concerning this meningococcus, stated that he found this germ always present in the nasal discharge of cases of meningitis.[1]

Councilman believes that the bacteriological examination of the fluid removed by lumbar puncture is of great importance.

Pathology.—In the early stage of this disease we note hyperæmic conditions in the brain and spinal cord. When the disease has progressed, the arachnoid appears cloudy, especially along the course of the blood-vessels from which a purulent exudate oozes. This purulent exudate involves all the tissues of the convexity and frequently extends to the base in the meshes of the pia and between it and the cortex. The fluid in the ventricles is, as a rule, increased, and may contain small flocculi of fibrin. Hæmorrhage is frequently noted in this region. The joints show evidences of septic inflammation. The spleen is frequently enlarged. Evidences of sepsis and infection are present in all parts of the intestinal organs of the body. Multiple abscesses may occur, and not infrequently parenchymatous degenerations involve the kidneys, liver, and spleen.

Purpuric spots or mottling, so frequently seen on the outside of the body, may sometimes be seen more distinctly in the internal organs.

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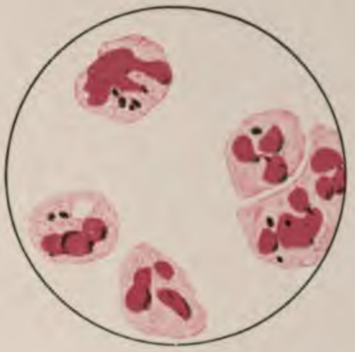
[1] Published *in extenso* in Charité Annalen, 1895, xx, p. 297.

PLATE XXV



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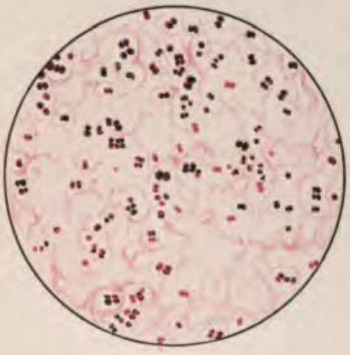

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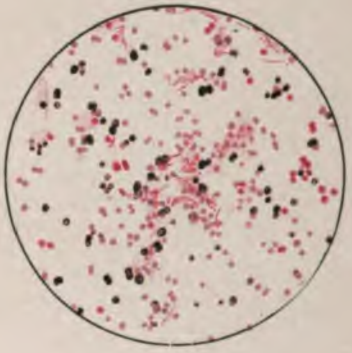

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1. Meningococcus or Diplococcus Intracellularis, derived from a lumbar puncture of a typical case. (Courtesy of Prof. A. Weichselbaum, of Vienna.)
2. Meningococcus Intracellularis, from a typical case of Cerebro-spinal Meningitis. Pure culture. (Courtesy of Prof. A. Weichselbaum, of Vienna.)
3. Micrococcus Catarrhalis. Pure culture. (Courtesy of Prof. Ghon, of Vienna.) (Original.)

TABLE No. 103.—*Deaths from Cerebro-Spinal Meningitis in Children under 15 years.—New York City—1895-1904.*

Year.	Old New York City.	Greater New York City.
1895	167	
1896 . . .	157	
1897	201	
1898	210	301
1899 . .	232	326
1900	153	251
1901	165	221
1902	156	221
1903	158	225
1904	805	1056

Councilman reports post-mortem examinations made in 35 out of 111 cases. In all but 4 the diplococcus was found in cultures, in the exudation, or in secretions of the tissues. In one of the negative cases they had previously been found in the fluid withdrawn by spinal puncture.

Lumbar puncture was performed in 55 cases; sometimes more than once. On microscopic examination or in culture, the diplococci were found in 38 cases. In 17 cases they were absent. The average time before puncture was seven days in the positive cases, and seventeen days in the negative. The spinal fluid was *sometimes clear, sometimes turbid.* The amount of fibrin varied greatly. No ill effects were seen from spinal puncture. In addition to the acute inflammation found in the meninges of the brain and cord, the inflammation of the meninges also extended along the cranial nerves and the anterior and posterior spinal nerve roots. In the pus obtained from secondary lesions in the eye and ear, the diplococcus was found; also in a majority of cases in the nasal secretions.

In 13 of the 111 cases, there was congestion or œdema of the lungs; in 7, broncho-pneumonia; in 2, croupous pneumonia. In all of these cases pneumococci were found, and in 8 cases the pneumonia was due to the diplococcus intracellularis.

The spleen and lymphatic glands revealed no special change; likewise the heart muscle, intestines, and skin. The liver presented no change beyond acute degeneration.

Symptoms.—The rapidity with which the symptoms of meningitis appear is the most noteworthy part of this condition. In very young children convulsions are among the early symptoms. Vomiting is a continuous symptom and is associated with restlessness and irritability.

Fever.—The fever is gradual and persistent. Not infrequently the temperature will rise to 102° or 103° F. on the first day, and increase until a temperature of 105° F. is reached. The reverse may also be true, and in some instances there is a *subnormal temperature* throughout the disease.

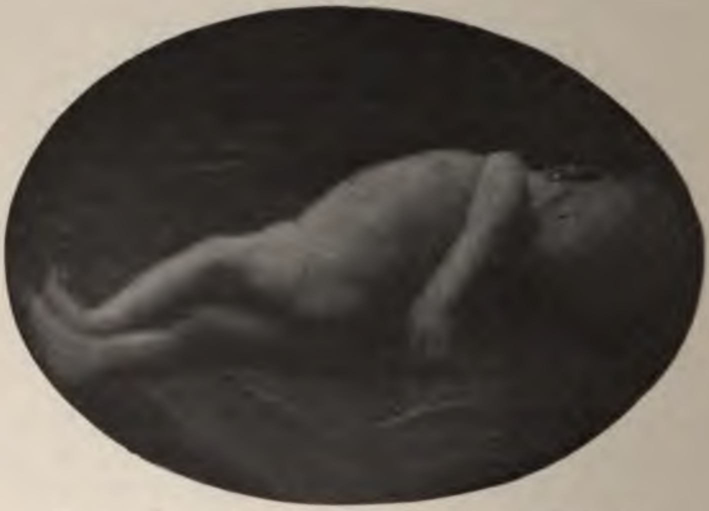

Fig. 268.—Case of Cerebro-spinal Meningitis. (Original.)

The pulse is very rapid as a rule, whereas in adults it is usually very slow.

The Eyes.—*The pupils* are generally dilated or they are unequal. *Strabismus and photophobia* are usually present, or an iritis, a keratitis, or a choroiditis may exist.

An intense purulent inflammation of the entire uveal tract, in which the eyeball is filled with pus, is frequently seen. This is called panophthalmitis.[1] In some cases pus breaks through the anterior portion of the sclera.

There is retraction of the head—not infrequently opisthotonos. The sleep is usually disturbed with muttering and delirium. There is twitching on either side or both sides of the body.

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[1] For a more complete description of panophthalmitis I would refer the reader to Dr. Charles H. May's book on Diseases of the Eye.

The Eruption.—On the skin will be found purplish mottlings in blotches of one-half inch or more in diameter. They do not fade on pressure. The skin is extremely sensitive, so that children cry when their skin is touched. Owing to vasomotor disturbances one area of skin will be found very hot, while another portion will appear quite cool to the touch.

In the digestive tract there is anorexia and usually constipation.

The respiration varies considerably, is frequently irregular, jerky, and assumes the Cheyne-Stokes type. The reflexes are, as a rule, exaggerated.

Kernig's sign is easily elicited in the following manner: The patient is placed in the dorsal decubitus, care being taken that the legs are relaxed and that there is complete extension of the knees. Should meningitis be present, the knees of the patient being raised to a sitting position, become more or less flexed, and despite all efforts they cannot be completely extended on account of the contracture of the flexor muscles while the patient remains in this position. In severe cases the knees may remain at an angle of 90 degrees. Complete extension can be accomplished only when the patient resumes the dorsal position. According to Netter, this symptom is present in 90 per cent. of all cases of meningitis, but has been found absent in all cases of typhoid fever, pneumonia, acute articular rheumatism, etc. He considers that the occurrence of this symptom confirms the diagnosis of meningitis when the symptoms are obscure, and suggests a latent meningitis when it is the only symptom present.

Lumbar Puncture.[1]—The subarachnoid space is frequently tapped for diagnostic and therapeutic purposes. The space between the third and fourth lumbar vertebræ is usually chosen. The child is placed on its right side with the spinal curve toward the operator, in this way spreading the vertebræ so that the greater angle formed by the vertebræ is toward the operator. In this manner the vertebræ are approximated on the anterior surface and are separated on the posterior borders. When inserting the needle in this position there is less risk of introducing the point into the vertebræ or into the side of the canal.

Place for Puncture.—An imaginary line drawn through the crest of the ilium, or the space corresponding to the posterior portion of the umbilicus and palpating a space a little to the left of the medium line, between the third and fifth lumbar vertebræ. Either space between the third and fifth is adapted to lumbar puncture.

Kind of Needle Required.—In making a puncture we should use such a needle as would be required in making a puncture for empyema. The needle should be pushed a little upward and forward, then the stylet should be withdrawn. If the fluid does not escape through the needle, then withdraw it slightly and reintroduce the stylet to dislodge any obstruction in the caliber of the needle.

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[1] First described by Quincke.

Make the puncture as simple as possible rather than lacerate the tissue around the vertebral column and cause bleeding by lateral movements of the needle.

Anæsthesia.—Locally ethyl chloride in the form of a spray or ether might be useful in a very sensitive child. It is not necessary to have a profound general anæsthesia during this procedure. *General rules of asepsis* must be strictly applied to the child's skin, the operator's hands, and to the needle used.

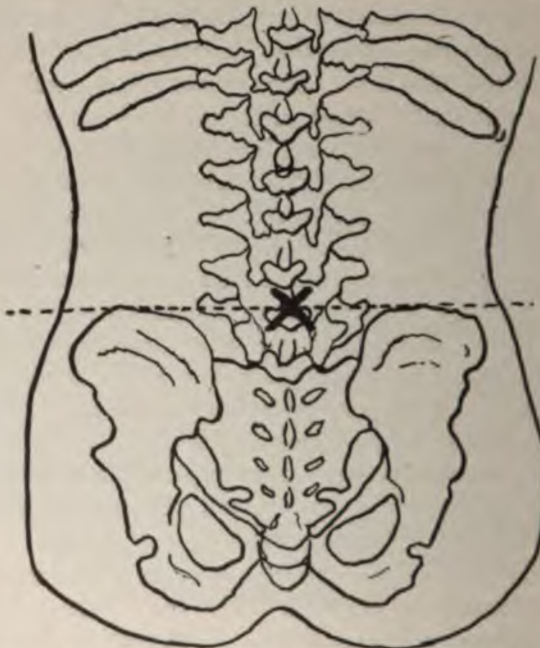

Fig. 269.—Anatomical Illustration Showing the Place Best Aadapted for Lumbar Puncture. The needle should be inserted in the lumbar space shown by the cross. (Original.)

Amount of Fluid to be Withdrawn.—I have withdrawn two ounces in one instance, although one ounce has been the rule. Lester Carr reports having removed three to four ounces at a time for a number of days in hydrocephalus. When fluid is withdrawn for diagnostic purposes then a small quantity, 10 to 15 cubic centimeters or about $^1/_2$ ounce, will suffice.

Sadie W., 9 years old, was seen by me in consultation with Dr. Leopold Harris, February 17, 1905. The child attended school on the day previous to being taken sick. The following morning she complained of headache, dizziness, and vomited several times. There was a sudden onset of all symptoms which surprised the family.

Stomach trouble was suspected and a cathartic given. Dr. Harris saw the case and diagnosed spinal meningitis. I saw this case about fourteen hours after the first symptoms appeared, and noted the following conditions: Temperature 104°; pulse varied between 90 and 120; it was very slow and irregular, and in one-half hour would change to an exceedingly rapid pulse. The child was comatose and screamed when her body was touched. There was marked rigidity of the head and neck, especially of the sterno-cleido-mastoid muscles. The arms and legs were extended and rigid; they would relax voluntarily. The patellar reflex was difficult to obtain. The plantar reflex was exaggerated. The Babinski phenomenon (hyperextension of the big toe) was present. Kernig's symptom was also present. There was a tache cérébrale. An eruption of a roseolar character and small petechiæ were found on the extremities. The pupils responded unevenly. One pupil was dilated, the other contracted. The child moaned continuously and seemed to be very uncomfortable. She passed urine and fæces involuntarily. I corroborated the diagnosis of cerebro-spinal meningitis and suggested an injection of diphtheria antitoxin, which was given at 2.45 A.M., February 18th, 4000 units of New York Board of Health antitoxin. On February 20th, at noon, 2000 units of Mulford's antitoxin was given by Dr. Harris. On the same day, at 4 P.M., I made a lumbar puncture by tapping the fourth lumbar vertebræ, and drew off 30 cubic centimeters of spinal fluid. A specimen of the fluid was sent to the laboratory[1] and the examination proved the presence of the diplococcus

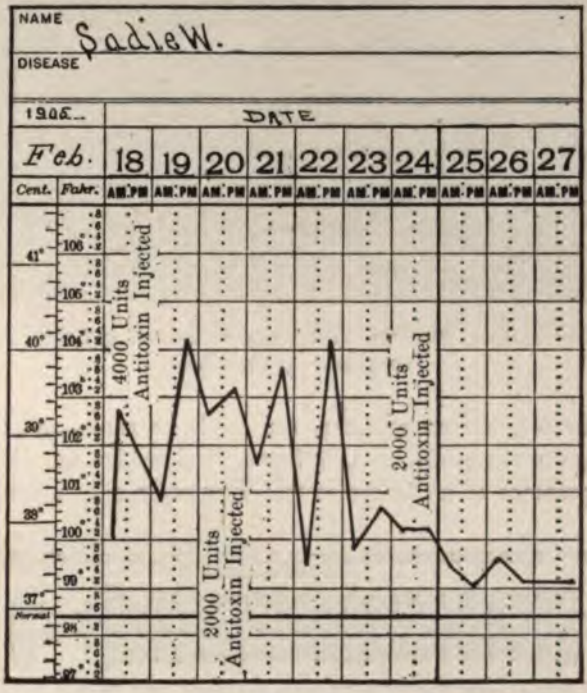

Fig. 270.—Case of cerebro-spinal Meningitis Treated with Antitoxin. Recovery. (Original.)

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[1] The spinal fluid was examined in the laboratory of the Health Department of New York City.

meningitidis. On the following day, February 21st, the child regained consciousness and retained some food. Persistent vomiting had existed for the preceding three days. February 23d, stupor gradually leaving the child. She cries and complains of pain in various parts of the body. February 24th, 4 P.M., gave final injection of 2000 units of New York Board of Health antitoxin. The child complains of double sight. Retains food.

No complications followed and an uneventful recovery was made.

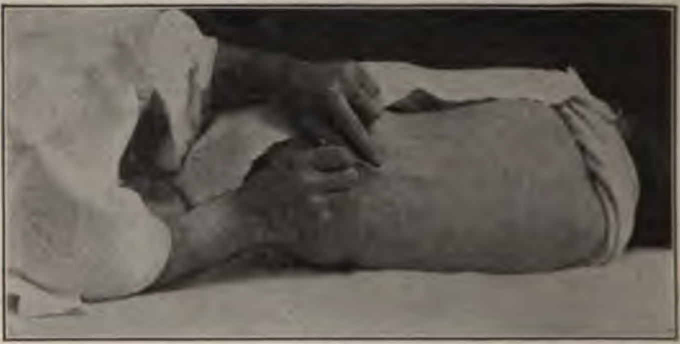

Fig. 271.—Lumbar Puncture Made Between Fourth and Fifth Lumbar Vertebræ. (Original.)

Diagnosis.—A lumbar puncture can easily be made, and the presence of the diplococcus intracellularis, if found, will render the diagnosis positive. The presence of an epidemic will frequently aid in making a diagnosis. Sometimes the eruption so resembles hæmorrhagic scarlet fever or hæmorrhagic measles that great care must be exercised in differentiating the same.

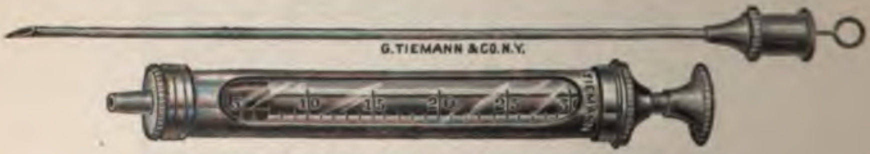

Fig. 272.—Lumbar Puncture Needle and Syringe.

Meningitis does not have the characteristic throat symptoms so common to scarlet fever, and this in itself will aid in differentiating the two conditions.

Course.—In the epidemic seen in New York City during the winter of 1903-1904, fatal cases were seen by me in which the duration ranged from twenty-four to forty-eight hours.

CASE I. A child, 3 years old, was seen by me in consultation with Dr. E. D. Lederman in the spring of 1904. It was a typical case of spotted fever with rash.

spasm of the sterno-cleido-mastoids, and fever. The child was in a stupor and moaned continuously. A lumbar puncture was made by Dr. Lederman and about one ounce of spinal fluid withdrawn. The diplococcus intracellularis was found. In spite of concentrated food, high saline enemata, and general restorative treatment given by a trained nurse, the child died on the fifth day of illness.

CASE II. A very severe case of spotted fever which occurred in a girl 15 years old was seen by me several times, in consultation with Dr. Henry A. Bernstein, through whose painstaking care the girl recovered. When I first saw this case the girl moaned continuously, vomited her food and medicine so that we were obliged to feed entirely per rectum. A lumbar puncture was made, but did not mitigate the symptoms. Stomach washing was tried to relieve the constant nausea. The convalescence lasted several months. There were no complications; the case was discharged cured.

Prognosis.—The prognosis is usually very bad. In an epidemic of 35 cases seen by me 21 died.

The epidemic form of this disease has a duration of weeks and frequently months, and when recovery takes place the child retains some form of paralysis, blindness, or deafness.

The sporadic type usually ends fatally in three or four days. Evidences of blood dyscrasia, such as extensive ecchymosis, are fatal signs. Continued convulsions or continuous hyperpyrexia with the resulting exhaustion, especially from inanition are fatal symptoms.

Treatment.—*Fever Treatment.*—Antipyretic measures such as cold pack, ice-bag on the head, and tub bath are indicated. The coal-tar products, owing to their depressing effect upon the heart, should be avoided.

Cupping of the neck and spine sometimes relieves internal congestion. Lumbar puncture should be used.

Eliminative Treatment.—This consists in cleansing the gastro-intestinal tract with the aid of citrate of magnesia or calomel, to relieve the constipation. When high fever exists, flushing the rectum and colon with a cold soap suds enema will be found useful.

Medicinal Treatment.—To relieve the vomiting cracked ice should be given in addition to 1-grain doses of menthol. To relieve muscular spasm, twitching, and delirium, hyoscine hydrobromate, in doses of $^1/_{600}$ to $^1/_{300}$ grain, repeated every few hours. Morphine, in doses of $^1/_{50}$ grain, hypodermically, gradually increased, is also valuable. Leeches applied at the nape of the neck or over the mastoid portion of the temporal bone or at the alæ nasi, will sometimes relieve. Sodium bromide, in 5 to 30-grain doses, may be given until the systemic effect is noted. Codeine, $^1/_{10}$ grain, gradually increased until $^1/_2$ grain is given, will frequently soothe the nervous system. The soothing effect of a warm bath is generally recognized. The bath should be given at a temperature of 100° to 105° F. in a large bathtub of water to which $^1/_4$ to $^1/_2$ pound of sulphur has been added. A warm sulphur bath may be given twice a day. The duration of each bath should be at least ten to thirty minutes. This warm sulphur bathing combined with a supporting diet served me better than all other treatment during the last two epidemics in New York City from 1903 to 1905 inclusive.

Treatment by Diphtheria Antitoxin.—Dr. Arthur J. Wolff, bacteriologist of the Health Department, of Hartford, Conn., found an antagonism existing between the Klebs-Loeffler bacillus and the meningococcus. He noted that pure cultures of the meningococcus were killed by the antidiphtheritic serum. Waitzfelder reports[1] a series of 17 cases; 5 recovered completely, 3 (2 adults) died, 9 still under observation. Five of the 9 indicate recovery. For the other 4 no prognosis can be given. My personal experience with antitoxin treatment is limited to 13 cases, 2 of which recovered. One case seen in consultation with Dr. Harris is described in this chapter. Another case seen in consultation with Dr. A. Bienenstock seemed to show some improvement after the injection of the antitoxin.

Dose Required.—Between 5000 and 10,000 antitoxin units can be injected on the first day. If no improvement is noted the dose can be repeated in twenty-four hours. The moment improvement is seen, such as a lessening of the rigidity, disappearance of the stupor, and cessation of nausea and vomiting, then the dose of antitoxin should be reduced one-half. It is very important to watch the emunctories and keep the bowels and kidneys very free, to aid the elimination of the toxin. Considering the fact that an occasional case formerly recovered without antitoxin, it is better not to attach too much importance to the success of an occasional case with antitoxin treatment.

Intra-spinal Injections.—After the withdrawal of 20 or 30 cubic centimeters of spinal fluid, an injection of $^1/_2$ per cent. lysol or a 1 per cent. collargol was tried by me without success.

Administration of Water.—As in all febrile conditions, so also here is water demanded. If there is extreme gastric irritability, a saline infusion into the colon may do some good.

Feeding.—Unless the strength is supported by food our patient will die of exhaustion. Feeding by mouth with peptonized milk, broth, gruel, and eggs is indicated. If, however, there is vomiting and the stomach does not retain food, then rectal feeding should be resorted to at intervals of three or four hours. This method of feeding has already been described in the chapter on "Infant Feeding."

After-treatment.—If the case progresses favorably, careful attention must be given to restorative treatment. Codliver-oil, iron, Fowler's solution, iodide of sodium, and the hypophosphites must not be forgotten. Electricity combined with massage and sea-salt bathing are valuable during convalescence. Milk, cream, butter, eggs, and cereals should be the bulk of restorative nutrition. A decided change of air from the city to the seashore or to the mountains will prove beneficial.

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[1] Medical Record, March 11, 1905.

ACUTE PACHYMENINGITIS (INFLAMMATION OF THE DURA MATER).

This condition frequently follows middle-ear disease, although it may be the result of injury to the cranium. It is frequently associated with inflammation of the pia mater (leptomeningitis). It is very difficult to diagnose. It usually follows ear disease and the symptoms of meningitis are associated. The treatment is surgical.

CHRONIC PACHYMENINGITIS.

Chronic pachymeningitis can be divided into two forms—hæmorrhagic and non-hæmorrhagic. There may be punctate hæmorrhages or there may be very large hæmorrhagic areas. Some authors state that this condition is very rare. It affects the inner layer of the dura mater. It is frequently called pseudo-membranous and hæmorrhagic, or hæmatoma of the dura mater.

Pathology.—The pathological findings in a typical case, in an infant six months old, are described by Holt: "The symptoms had existed for six days. The fontanel was bulging to a marked degree, and the sagittal and coronal sutures were separated. A thin recent clot from one-eighth to one-fourth of an inch in thickness covered nearly the whole of the right hemisphere and part of the convexity of the left. The entire dura was lined both at its convexity and base by a pseudo-membrane of grayish color, about one-sixteenth of an inch in thickness. The brain was anæmic. In cases of longer standing partial organization of the clot may be seen; in more recent ones the blood is partly or entirely fluid. I once found acute leptomeningitis with a purulent exudation, associated with hæmorrhagic pachymeningitis." In cases where life is prolonged for years, there may be partial or even complete absorption of the clot, followed by the formation of cysts, considerable inflammatory thickening of the pia with deposits of blood pigment, and finally atrophy and sclerosis of the cortex. The source of the hæmorrhage may be the rupture of a single large vessel, but more frequently the blood comes from many small vessels.

Symptoms and Diagnosis.—It is very difficult to give positive symptoms by which this condition can be recognized during life. Coma, convulsions, stupor, and vomiting are the main symptoms. Unilateral hæmorrhage causes rigidity affecting one arm and leg, but if the hæmorrhage is diffused all the extremities are affected. The pupils may be dilated or contracted; sometimes one pupil is dilated and the other is contracted. The respiration and pulse are slow and irregular. There is usually fever, the temperature being as high as 105° or as low as 100° F.

Opisthotonos may be absent. The patellar reflex is usually exaggerated. Convulsions appear and death ends the scene.

The differential diagnosis, according to Holt, is as follows: "Without large hæmorrhages, pachymeningitis interna cannot be diagnosticated; and it is impossible to differentiate the hæmorrhagic cases from other varieties of meningeal hæmorrhage. It is important to make a diagnosis between pachymeningitis with hæmorrhage; and acute simple meningitis. In the former we have a sudden onset; stupor occurring early, usually on the first day, gradually diminishing in cases of recovery, or deepening into coma in fatal cases; localized or general paralysis, also occurring early; there is no fever in the beginning, and only moderate fever at the close. In acute meningitis we usually have a higher temperature, especially early in the disease; coma develops later, and rigidity of the extremities is less pronounced. In certain cases, however, where the hæmorrhage occurs in the course of some other disease, a differential diagnosis may be impossible."

The prognosis is usually fatal. If small hæmorrhages take place, the paralysis may remain for years.

Treatment. — The scalp should be shaved and an ice-bag applied. Leeches should be applied to the mastoid to relieve cerebral congestion. Large doses of bromide and ergot will sometimes do good. The emunctories must be carefully watched and aided if necessary.

CEREBRAL PARALYSIS (SPASTIC DIPLEGIA. PARAPLEGIA. HÆMIPLEGIA).

There are two forms of palsy usually seen. When the face, arm, or leg is palsied it is called monoplegia. When the two lower extremities are affected, paraplegia. When one side is affected, hæmiplegia. When both sides are affected, diplegia.

They occur in one of three periods: first, during intra-uterine life (prenatal); second, traumatism during labor; third, palsies after birth of the child.

Etiology.—Injury to the mother frequently injures the cerebrum of the fœtus. Toxic conditions, especially those associated with the infectious disease resulting in muscular degeneration, frequently cause palsy. Compression of the infantile brain and its circulation during a slow labor may produce thrombosis or meningeal hæmorrhage. This condition is most liable to occur in a primipara. Whooping-cough has caused cerebral hæmorrhage and injury and compression to the cortex ending in paralysis.

Syphilis may be a frequent cause of this condition. Epilepsy is found in over two-thirds of all cases as a sequela.

Pathology.—Very interesting data are contributed by Peterson and Sachs, to whom I am indebted for the following classification:—

TABLE No. 104.

Groups.	Pathological Changes.
I. Paralyses of intra-uterine onset.	LARGE CEREBRAL DEFECTS (true porencephaly).
	HÆMORRHAGES OF INTRA-UTERINE origin (softening?).
	AGENESIS CORTICALIS.
II. Paralyses occurring during labor.	MENINGEAL HÆMORRHAGE (very seldom intra-cerebral). Resulting conditions: meningo-encephalitis chronica; sclerosis; cysts; atrophies (porencephalies).
III. Paralyses acquired after birth.	MENINGEAL HÆMORRHAGE (very seldom intra-cerebral); EMBOLISM; THROMBOSIS (in marantic conditions and occasionally from syphilitic endarteritis). Results of these vascular lesions; cysts; softening; atrophy; sclerosis (diffuse and lobar).
	CHRONIC MENINGITIS.
	HYDROCEPHALUS (seldom the sole cause).
	PRIMARY ENCEPHALITIS (Strümpell) (?).

"A summary of the pathological lesions resulting from acute apoplexies consists of atrophies, sclerosis, and other changes due to hæmorrhage; also, embolism and thrombosis."

"Fatty degeneration of the blood-vessels is the probable explanation of the escape of blood in a large number of cases." Heart lesions, pneumonia, and other infectious diseases predispose to embolism.

The secondary changes result in sclerosis or areas of softening. "The sclerosis is largely responsible for the imbecility and epilepsy; transverse fibers connecting intimately all parts of the hemispheres."

Spencer studied 130 cases of still-born children. He found 53 cases due to hæmorrhage from the pia and arachnoid. In 29 cases there was bilateral hæmorrhage, 10 in the left side only; 10 in the right side; 7 in the lateral ventricles; 6 at the base of the brain; 1 case of intra-cerebral hæmorrhage; 4 cases of thrombosis of the longitudinal sinus.

The following case occurred in the practice of Dr. A. C. Cotton, of Chicago:—

Edith N., age 10 years, oldest in family of four children. Others normal. Mother not in good health during gestation. Labor lasted twelve hours. No forceps. Child was always irritable, but had no convulsions until four months of age, when first tooth appeared. There were frequent recurrences of spasms, two to four daily. Has never walked, stood alone, nor been able to support her head. The circumference of the head was nineteen inches.

Present Condition.—The skin is cool, with a tendency to cyanosis. The body is emaciated; there is a flaring of the ribs, and the spleen shows a distinct scoliosis.

The mouth is open so that the saliva constantly dribbles. The jaws are deformed and the face presents a starched appearance. There are contractures and spasticity in both upper and lower extremities. The reflexes are exaggerated. Intelligence *nil.*

Symptoms and Diagnosis.—The following symptoms are common to all forms of palsy: Rigidity of the muscles, contraction of tendons, and exaggeration of all the deep reflexes. Convulsions and coma commonly precede the diseased state. Most cases of diplegia and paraplegia are congenital, while most cases of hæmiplegia are acquired after birth.

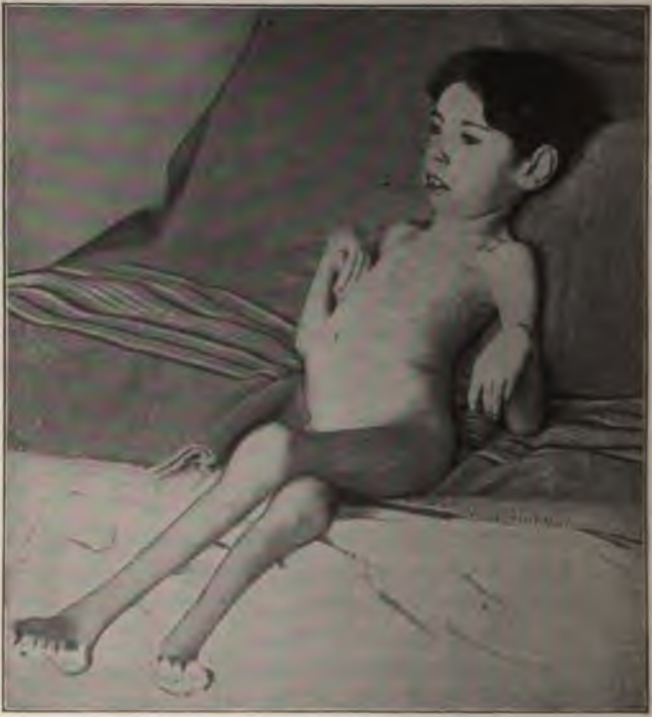

Fig. 273.—Infantile Cerebral Paralysis. (Kindness of Dr. A. C. Cotton.)

Palsies usually follow a difficult labor. Strabismus and facial paralysis are frequently noticed. Aphasia may be present in children that had previously learned to talk. The reflexes on the affected side, knee and elbow, are usually exaggerated (Peterson, Taylor, and Wells).

When athetosis is found, it is usually associated with imbecility and idiocy.

In associated movements the exact imitation of the paralyzed hand

and fingers of voluntary movements made by the normal hand and fingers takes place. Choreiform movements, called by Weir Mitchell post-paralytic chorea, are frequently mistaken for chorea. Peterson[1] describes two congenital hæmiplegias—a hitherto unnoted morbid movement to which he has given the name *post-hæmiplegic polymyoclonus.* The movements are neither choreiform nor athetoid, but are constant clonic contractions of most of the muscles in the limbs affected, not occurring synchronously, and the rhythm being about that of paralysis agitans (five per second). All of these movements indicate interference with motor conduction due to lesions in some part of the voluntary and inhibitory tracts.

The following schedule of symptoms by Jacobi is useful in showing the diagnostic features of the different palsies:—

Upper Extremity.—Deltoid: Absence of deformity, which is averted by weight of arm. Inability to raise arm. Sometimes subluxation. Frequent association with paralysis of biceps, brachialis anticus, and supinator longus.

Lower Extremity.—Ilio-psoas: Rare except with total paralysis. Associated with paralysis sartorius. Loss of flexion of thigh. Limb extended (if glutei intact).

Glutei.—Thigh adducted. Outward rotation lost. Lordosis on standing. Frequent association with paralysis of extensors of back.

Quadriceps Extensor.—Flexion and adduction of leg (if hamstrings intact). Loss of extension of leg. Frequent association with paralysis of tibialis anticus.

Tibialis Anticus.—Often concealed if extensor communis intact. If both paralyzed, then fall of point of foot in equinus. Dragging point of foot on ground in walking. Big toe in dorsal flexion (if extensor pollicis intact). The tendons prominent. Hollow sole of foot (if peroneus longus intact).

Extensor Communis.—Nearly always associated with that of tibialis anticus. Toes in forced flexion.

Peroneus Longus.—Sole of foot flattened. Point turned inward. Internal border elevated.

Sural Muscles.—Heel depressed. Foot in dorsal flexion (calcaneus). Sole hollowed if peroneus longus intact; flattened if paralyzed. Point turned outward (calcaneo-valgus).

Extensors of Back.—Lordosis on standing. Projection backward of shoulders. Plumb-line falls behind sacrum (unilateral). Trunk curved to side. Trunk cannot be moved toward paralyzed side.

Abdominal Muscles. — Lordosis without projecting backward of shoulders.

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[1] Starr. American Text-book Diseases of Children, p. 652.

Rigidity and contractures are striking symptoms in almost all these palsies, and for this reason they often fall into the hands of the orthopædic surgeons, who are besought to remedy the rigidly-flexed elbows, wrists, knees, and the various deformities that interfere with locomotion. Adductor spasm in the thighs, causing cross-legged progression, is nearly constant in diplegia and paraplegia. Talipes equino-varus is the most frequent pedal deformity in hæmiplegia. Rarely talipes equinus and talipes equino-valgus are to be found in hæmiplegia. While rigidity with contracture is the rule in all of these forms of infantile cerebral palsy, occasionally, but very seldom, cases will be met with in which the muscles are all completely flaccid. The chief *trophic disturbance* encountered in these cases is retardation in growth of the paralyzed member. The paralyzed limbs do grow, but at a much slower rate than the sound extremities. Hence the disproportion is often very striking. The earlier the onset of the palsy, the greater is this disproportion. Another peculiarity noted is that the growth of the whole organism is to a certain extent interfered with, the injury to the brain seeming to stunt development and to prevent the patient attaining his normal stature. The patients are more or less undersized and dwarfed. Peterson describes a case in which the mother brought to him her two boys, twins, 6 years of age, for the examination of the one affected. One was a tall, well-built lad; the hæmiplegic boy was small-bodied and fully seven inches shorter than his healthy brother. In all of these cases the muscles of the paralyzed and undeveloped extremities react normally to the faradic current. There is no reaction of degeneration. In many cases the affected limbs may be blue and cold, as in paralysis of the spinal type. A very rare phenomenon in these cases is a hypertrophy of the muscles, usually combined with athetosis.

Asymmetry of face and skull have been observed. Peterson and E. D. Fisher have called attention to the flattening of the skull on the side opposite the paralysis in infantile spastic hæmiplegia.

Differential Diagnosis.—From infantile spinal paralysis we can differentiate, by the presence of the exaggerated reflexes, the rigidity and normal reaction of the muscles. In cerebral palsy there is no actual atrophy in the limbs. When the central neuron is involved, the inhibitory influence over reflex manifestation is lost; consequently there is an increased reflex. When the peripheral neuron is involved, the circuit being broken, the reflex is lost. There are no marked trophic changes.

Prognosis and Course.—In diplegia and paraplegia due to intra-uterine or birth[1] lesions they rarely reach the third year. As a rule they die of marasmus in infancy. In hæmiplegia the prognosis is better. In most cases the paralysis may improve and the brain may not be seriously impaired. If epilepsy appears in later life, we may suspect a previous infantile paralysis.

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[1] See article on "Erb's Paralysis or Birth Palsy in the New-born Baby."

The palsy affecting the face and the leg can usually be improved. Speech will also gradually return if improvement is noted. The late appearance of epilepsy must not be forgotten. Sometimes the paralysis is present a year or more before the onset of the epilepsy (Peterson).

Treatment.—If convulsions are present, the inhalation of chloroform or laughing gas is indicated. Anti-spasmodics, such as bromide of potassium or bromide of sodium, with or without chloral hydrate, can be given. General attention to the stomach and bowels—and dietetic management is certainly indicated. Iodide of sodium is also indicated. Counter-irritants cause excitement and sometimes do harm. J. Madison Taylor advises against the use of counter-irritants. Electricity combined with massage is useful. The faradic interrupted current will do good by stimulating the muscles. The current should be used daily; besides careful massage (muscle kneading), passive movements are of great importance. This form of exercise should be resorted to and more *good can be done* by this form of treatment than by all medication. We must not expect the bodily functions to return to normal until we have strengthened the body with restorative treatment, combined with fresh air, and by all means light nutritious food.

Some cases will not yield to medicinal treatment, and here surgical procedure has been advised. Neither trephining nor craniectomy have been successful. Allen Starr reports in a recent paper that in fifty cases operated, in these and allied conditions, the results were not encouraging.

A child 3 years old was brought to my clinic at the New York Post-graduate Medical School and Hospital in 1894. It was suffering with backward development and had distinct evidences of cerebral palsy. There was a diplegic paralysis. The head was microcephalic. As nothing could be done by general routine treatment, it was decided to try surgical treatment. A craniectomy was performed by Dr. Seneca D. Powell. The child died.

Two other cases known to me have been operated, and the surgical treatment in each has been disappointing.

PLEUROPLEGIA (MOBIUS'SCHE KERNSCHWUND).

This is a congenital condition caused by a combination of abducens, facial, and hypoglossal paralysis.

This condition is caused by nuclear defects, and the partial palsies are evidently due to lack of intra-uterine development. The following case illustrates this condition:—

C. M. G., born May 4, 1898, was referred to me for diagnosis by Dr. Henry A. Bernstein.

Family History.—It is the first child. The mother has had two miscarriages since the birth of this child. The parents are not related by birth. Syphilis can be positively excluded.

Child's History.—She was breast-fed for three months; later received bottle feeding. When five months old it was noticed that the infant could not support its head. Dentition began at seven and one-half months. Did not walk until the third year. Had measles and also diarrhœa about this time and ceased walking, but began to walk again during the fifth year. Talking began when 5 years old. Could not connect words until 6 years old. Is inclined to constipation. Adenoids were removed when 3 years old.

St. pr.—Now 7 years old. The heart sounds are clear and normal, although heart action is slow (bradycardia). The head moves normally. There is a funnel-shaped depression of the thorax, also a spinal curvature, pendulous belly, carious teeth, besides other symptoms of rickets. *The nasolabial folds are totally absent. There is an absence of expression—no difference in laughing or crying.* The saliva flows out of the mouth. The eyes do not close during sleep (lagophthalmus). The iris disappears under the lids in attempting to close them. There is an absence of the secretion of tears. No fibrillary contractions of the tongue are visible. The uvula is in the median line just as in the normal child.

Treatment.—Restorative treatment consisting of proteid food and general hygienic treatment to improve the rachitis was ordered.

Codliver-oil and phosphorus may be tried, as also large doses of iodide of sodium. Faradic electricity is indicated.

PSEUDOHYPERTROPHIC PARALYSIS (MUSCULAR PSEUDOHYPERTROPHY).

We are indebted to Duchenne for an accurate clinical description of this condition.

Etiology.—This disease is usually found in children between the second and eighth years. It is more frequently observed in males than in females. There is no distinct cause of this disease.

Pathology.—The pathological lesions noted are a fatty infiltration of the muscles, changes in the breadth and contour of the muscular fibers, and an increase in the intermuscular connective tissue.

Symptoms.—Motor-weakness is usually the first thing noticed. A child apparently in good health will complain of inability to walk. At the same time there will be an enlargement of certain groups of muscles. In cases seen by me the muscles of the calves were almost as large as those of the thighs. Stewart has reported cases in which the calves of the child were as large as those of an adult. The muscles most frequently affected are the deltoids, biceps, triceps, latissimus dorsi, and sterno-mastoids.

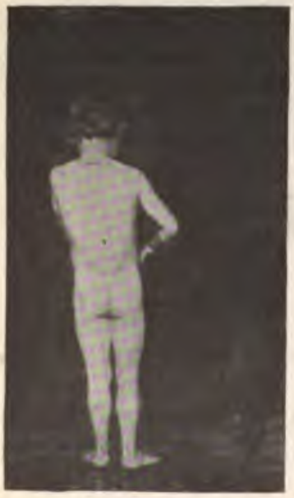

Fig. 274.—Pseudohypertrophic Paralysis.

I am indebted to Dr. Dexter Ashley for the above illustration.

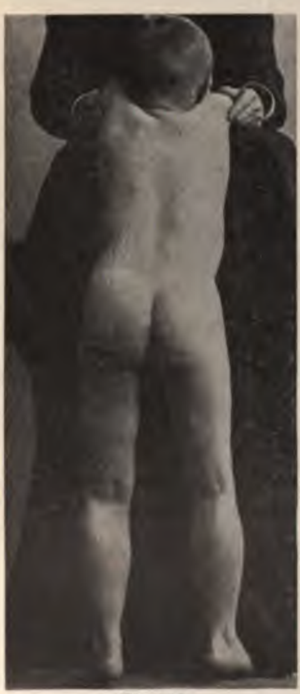

Fig. 275.

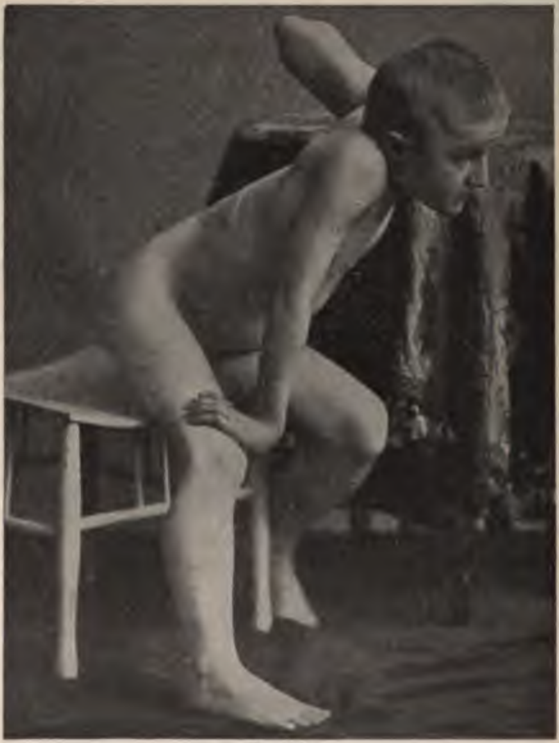

Fig. 276.

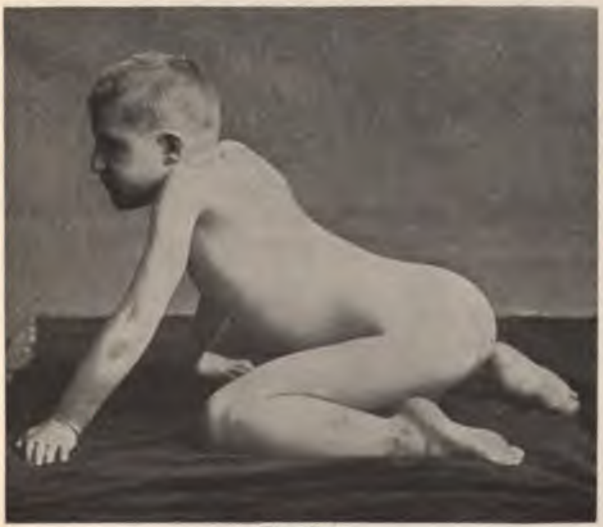

Fig. 277.

Pseudohypertrophic Paralysis.

Fig. 275.—Note hypertrophic condition of the muscles of the legs. Cannot stand without strong support. (Original.)

Fig. 276.—Attempting to rise from chair. Compare atrophy of muscles of arms and spine with hypertrophy of muscles of legs. (Original.)

Fig. 277.—Attempting to rise from floor. Can raise the body no higher. (Original.)

Duchenne has found all of the muscles of the body hypertrophied. After the hypertrophy disappears it is succeeded by an atrophic condition. There is less muscular irritability with faradic and galvanic currents. The patellar reflex is usually absent as the disease progresses.

CASE I.—A. L., 6 years old, boy. As a baby the mother noted that there was something the matter. Walked at 2 years of age. Child was very fat, and had a good appetite at that time. Now eats but little.

Walks very erect, in soldier-like position, almost suggesting Pott's disease. Steps slowly. On table, first noted apparently strong muscular development of the back. Muscles of back, thigh, calves, apparently well developed. Child rises from the floor with characteristic movements. Flat-footed. Cannot get up without rolling over, when reclining on back. Child looks to be in good health. Father says he is constantly growing weaker, slowly. Came to me for diagnosis, not having previously known the nature of the condition.

CASE II.—Jacob S. was first seen by me when 12 years old. Walking became impaired at the age of 6 years, gradually getting worse, so that to-day he cannot walk at all. The reflexes are absent. Sensation is impaired. The spinal muscles in dorsal region are atrophied. Gastrocnemii markedly increased in size. The extreme difficulty of rising from a sitting position is very characteristic (Fig. 276). The loss of power in arms is quite marked also. A history of diphtheria is given just prior to the onset.

Dr. L. S. Manson kindly referred this case to me.

Prognosis.—The prognosis as a rule is bad.

Treatment.—The treatment consists in restoratives. Massage may be tried. Such a case should always be sent to a neurologist to outline the future course of treatment.

FACIAL PARALYSIS IN THE NEW-BORN.

This condition is most frequently seen in the new-born after the use of the forceps. It is a peripheral paralysis resulting from traumatism. It is the result of pressure on the nerve near the exit through the stylo-mastoid foramen or where the facial nerve crosses the ramus of the jaw. The parotid gland gives little protection in the new-born. The paralysis is most frequently unilateral, as usually only one blade of the forceps causes injury.

FACIAL PARALYSIS (BELL'S PARALYSIS).

This is frequently called post-operative palsy. This disease may follow mastoid operation. It may also follow retropharyngeal abscess (Bokai).

The disease is sometimes associated with tumor in the cerebellum.

Facial palsy, rheumatic type, has been seen by me following an exposure to a draught in a child 6 years old. There was a slight flattening of the facial muscle, also lagophthalmos which lasted nine days. The treatment by gentle faradic electricity and also small doses of salicylate of soda seemed to do good.

Prognosis and Course.—Great care should be exercised in expressing an opinion as to the outcome of a case of facial palsy. In one case seen by me after a mastoid operation a permanent palsy remained. I saw the case four years after the operation.

Treatment.—This depends on the cause. Restorative treatment aided by massage and electricity should be tried. Unless some improvement is noted within a few weeks the outcome of the case will be serious.

ABSCESS OF THE BRAIN (CEREBRAL ABSCESS).

This condition is occasionally seen in children.

Etiology.—There are two principal causes of this condition: first, traumatism—injury to the head by a blow or a fall, resulting in fracture of the skull or in abscess; second, from an extension of middle-ear abscess into the mastoid cells, so that an abscess of the cerebellum results. The infection is carried through the veins or usually along the lateral sinuses to the cerebellum. Wagner reported a case of cerebral abscess in which thrush was believed to be the cause.

The white substance of the brain is usually affected in this suppurative process. It is rarely seen in children under 1 year of age, but more frequently between the ages of 1 and 10 years. Out of 223 cases reported by Gower, 24 occurred between the ages of 1 and 9 years. Körner's statistics show that out of 77 cases of brain abscess, 25 were secondary to ear disease.

In 38 out of 40 cases, according to Körner, the bone itself is diseased.

Pathology.—Meyer reports a case of abscess which occupied an entire hemisphere. The pus found is usually greenish-yellow. At times the abscess may be encysted, in which case it is surrounded by a pyogenic membrane. Lalemand reports a case of abscess of the brain in which there was an escape of pus through the auditory meatus. "The most frequent seat of the abscess is, first, the temporo-sphenoidal lobe; secondly, the cerebellum; thirdly, the frontal lobes. Other locations are very rare. Abscesses are usually single. In size they vary from that of a cherry to an orange."

"Abscess of the brain, as well as meningitis and sinus-thrombosis secondary to otitis, begin, as a rule, at a point corresponding to that at which the inner surface of the bone is attached. The roof of the tympanum enters into the middle fossa, and the bony partition is sometimes as thin as writing-paper; it is for this reason that disease of the middle ear most often causes abscess in the temporo-sphenoidal lobe which lies on the fossa.

The mastoid cells are separated from the posterior fossa by a thin layer of bone, and hence abscess, secondary to disease in that region, is often situated in the cerebellum. The extension of the disease to the brain is due to thrombosis extending from the diseased bone, or from the ear, through the veins which pierce the roof of the tympanum; only rarely is there a direct communication by a suppurating tract. In common with other forms of intracranial inflammation due to ear disease, abscesses occur more often on the right than on the left side."

Symptoms.—If the child is old enough to complain, there will be headaches described over the affected area. Fever usually accompanies this condition. The temperature may rise to 104° or 105° F. in the beginning, although cases are reported where the temperature remains normal. Vomiting usually accompanies this condition. At times in young children there are convulsions, coma, opisthotonos, and all symptoms pointing to a meningitis. When distinct areas are affected, such as the motor areas, then paralysis of the extremities may take place. Optic neuritis is sometimes present. A choked disc can sometimes be made out by an ophthalmoscopic examination. If the bones of the cranium are thin then there is usually marked tenderness over the region of the abscess.

A foundling,[1] eleven months old, was in a fair condition when first seen by the foster parents, who later adopted him. This infant subsequently developed sore eyes and still later had several bruises on the scalp which suppurated. In addition thereto he was emaciated and showed the evidence of both neglect and improper feeding. The infant with proper feeding and hygienic care developed into a bright healthy boy. He attended school and seemed in good health until his seventh year, when he showed signs of trouble with his head. Dr. W. B. Chapin, who attended him, suspected caries of the bones back of the ear.

Dr. W. Freudenthal was called in consultation with Dr. Chapin to see the swelling behind the ear, which had developed during the previous eight weeks. The swelling was about the size of a large cherry, there was no pain on palpation and no spasmodic contractions. The swelling was located on the side of the head corresponding to the upper lobe of the ear. It was not reddened and fluctuated on palpation. Examination of the ear showed no pathological condition. The drum membrane was normal. There was no tenderness over the mastoid.

After waiting some time it was thought advisable to open the abscess. The abscess was opened by Dr. Freudenthal with general anæsthesia. Necrotic tissue was found, but the mastoid was intact, and it was impossible to probe the mastoid cells; however it was found that a small probe penetrated in the direction of the frontal lobe to the depth of 3 1/4 inches. Pus oozed from this opening. As this was evidently a case of cerebral abscess, the wound was dressed and the further operative procedures left to a surgeon. The temperature ranged between 99° and 104 1/2° F. The abscess was on the right side of the head. Convulsions occurred on the left side of the body. Dr. A. Gerster was called in and diagnosed the case as a cerebral abscess. On the following morning an operation was performed. To be sure that the mastoid was not involved, part of the mastoid was opened. It was found normal. Two ounces of pus were evacuated from the abscess. The case ended fatally.

Diagnosis.—This is usually made when suppuration of the middle ear existed prior to this attack. If opisthotonos, symptoms of coma, convulsions, high fever, or vomiting follow an attack of acute or sub-acute otitis, then an extension of the suppurative process *should be suspected.* At times the diagnosis will tax the ingenuity of the most expert aurist.

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[1] I am indebted to Mr. Saul Japha for the clinical history of this foundling.

Prognosis.—This is always grave. Our only chance for saving life is to resort to an early operation.

Treatment.—The earlier surgical relief is instituted, the better will be the result. The medicinal treatment consists in relieving symptoms such as fever by means of an ice coil, and by active catharsis. Relieve the nervous symptoms with the aid of large doses of bromide and chloral. Complete details of brain surgery are given by M. Allan Starr in his book on "Brain Surgery."

ALALIA IDIOPATHICA[1] (BACKWARDNESS IN SPEAKING).

When a child is in good health and does not learn how to speak, careful examination is necessary. In such cases it is important to exclude idiocy. Although some children do not speak before they are 2 or 3 years old, their general habits and mannerisms will easily show whether or no we are dealing with mental disease.

The prognosis is excellent, although frequently parents will be very anxious and worried regarding the outcome.

Treatment.—Persistent teaching will usually remedy this condition.

IDIOCY AND IMBECILITY.

In idiocy we have a congenital absence of mentality and intelligence.

In imbecility we have an arrested development or a partial arrest of development.

Etiology.—According to Shuttleworth prolonged labor without instrumental interference is the cause of idiocy in 29 per cent. of cases admitted to his asylum. Down states that of 2000 idiots examined by him there were symptoms of suspected inanition at birth in 20 per cent. This writer also states that disturbance of the mother's physical condition during pregnancy resulted in mentally deficient offspring in about 20 per cent. Griesinger states that "violent shock and grief during pregnancy appear not to be without influence as a cause of idiocy." Consanguinity is a much disputed point. Some authors believe that blood relations invariably have mentally deficient offspring. Other equally observant writers hold the opposite view. I have seen a case of idiocy in which the father and mother were first cousins. Children of intemperate parents, and children of syphilitic and tubercular parents are frequently found to be mentally deficient.

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[1] Read also, "Very Late Speaking," Part I, page 3.

Shuttleworth, a well-recognized English authority in this field, gives the following classification of idiocy:—

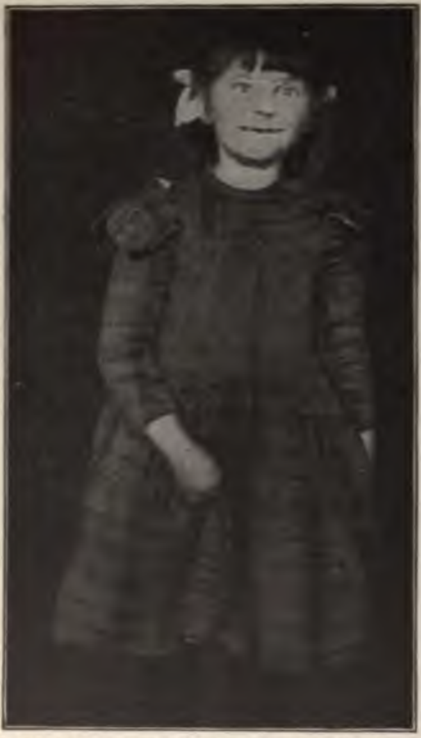


Fig. 278.—Congenital Idiocy (Lillie B.). Age 6 years. Delicate until 4 years of age. Did not walk until the fourth year. Mother cannot tell when difference in the two sides was first noted. There were no convulsions. The head measured 19 inches. There were strabismus, and deformed jaws. The mouth was constantly open. Right hemiplegia, more marked in upper extremity. Walks and runs around, but drags right foot. Contracture and spasticity present. Expression idiotic. Has never talked. Intelligence *nil*. Is restless and in nearly constant motion. (Case of Dr. A. C. Cotton.)

TABLE No. 103.

CLASS A—CONGENITAL.

1. Microcephalic.
2. Hydrocephalic (also non-congenital).
3. Scrofulous. "Mongol type."
4. Sensorial (also non-congenital).
5. Primarily neurotic.
6. Paralytic (also non-congenital).
7. Choreic (also non-congenital).
8. Cretinoid: (*a*) sporadic, (*b*) endemic.

CLASS B—NON-CONGENITAL.

(a) Developmental.

9. Eclamptic.
10. Epileptic.
11. Syphilitic.
12. Post-febrile (also *accidental*).

(b) Accidental or Acquired.

13. Toxic.
14. Traumatic.
15. Emotional.
16. From mixed causes.

Symptoms and Diagnosis.—Great care must be taken in differentiating between backwardness and idiocy. A child that is backward in development does not remain stationary in development, but progresses *very slowly in comparison* with children of the same age; for example, a backward child of 5 or 6 years will show the mental development of a child but 2 or 3 years old. In such a case we deal with a slow mental progress, whereas an idiot shows a distinct arrest of development, both of body and mind.

Down describes Mongolian idiocy in the following language: "The hair is not black as in the real Mongol, but of a brownish color, straight and scanty; the face is flat and broad, and destitute of prominence; the cheeks rounded and extended laterally; the eyes obliquely placed, and the internal canthi more than normally distant from one another (the epicanthic fold often abnormally large); the palpebral fissure very narrow;

the forehead wrinkled transversely, from the constant assistance which the levatores palpebrarum derive from the occipito-frontalis muscle in the opening of the eye; the lips large and thick, with transverse fissures; the tongue long, thick, and much roughened; the nose small; the skin has a slightly dirty, yellowish tinge, and is deficient in elasticity, giving the appearance of being too large for the body.

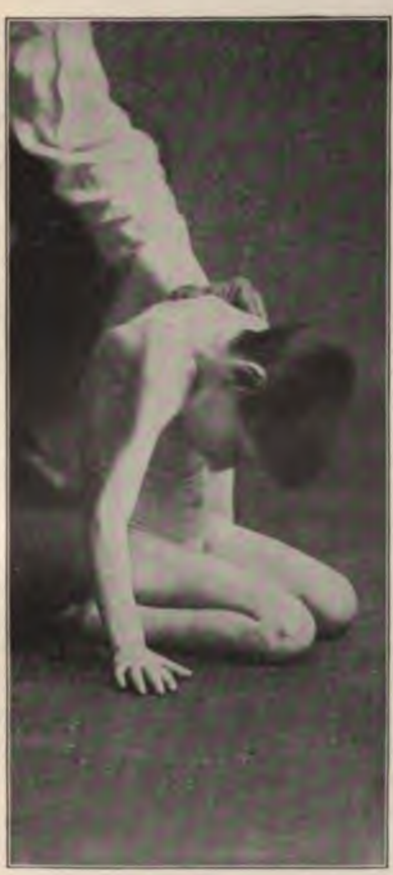


Fig. 279.—Imbecile (Louie W.). Showing anterior curve of the spine and general atrophy of all the muscles, especially those of the back and shoulders. (Original.)

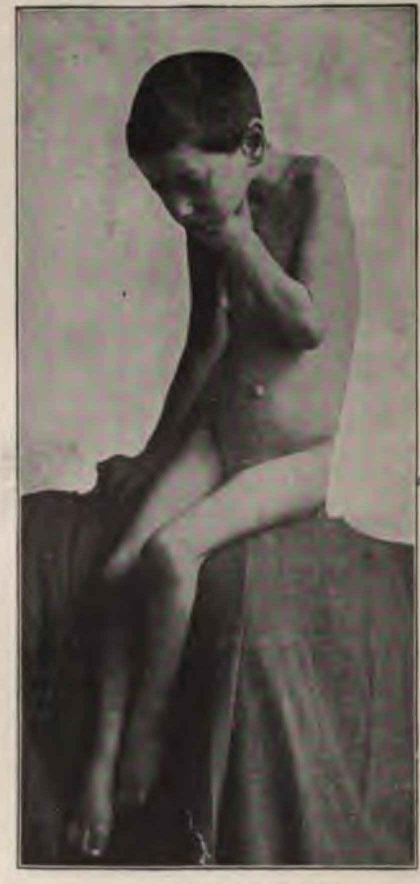


Fig. 280.—Imbecile (Louie W.). Showing normal position of head flexed on the chest. Can only lift head by raising chin with extensor muscles of hand and forearm. (Original.)

"This type occurs in more than 10 per cent. of cases; they are always congenital idiots; they have considerable power of imitation; they are humorous; they are usually able to speak, the co-ordinating faculty is abnormal; the circulation is feeble; the improvement which training effects is greatly in excess of what would be predicated if one did not

An Imbecile Having Microcephaly and Pseudo-muscular Atrophy.—Louie W., 5 years old, was referred to me through the courtesy of Dr. L. S. Manson.

Previous History.—This child was born at full term, natural labor, no forceps. He was breast-fed about 15 months; could not stand, walk nor talk until 2 years old. Dentition began during the ninth month, which was very early in this family, as all the other children teethed at fifteen months. He had measles when 2 years old, influenza and pneumonia when 3 years old. The boy has an unusually small skull, 16 inches in circumference; the normal circumference at this age is about 21 inches.

Family History.—The mother had been married twice, had six children with the first husband and five with the second. Three children died of scarlet fever. The rest of the children are strong and healthy. There is no family history of idiocy or nervous disease on either father's or mother's side.

The mother first noticed trouble when the child was 2 years old, when he began to go about on his knees, having never walked on his feet. He has no power in the hands or feet; speaks very little, voice tremulous. Tic of small muscles of chin; knee-jerk both present. There is great muscular weakness of the lower extremities and muscles of the back. There was drop-wrist and foot and universal wasting of the muscular system without marked trophic changes. Normal position of head is that of flexion on chest and can only lift head by raising chin with extensor muscles of hand and forearm. Fibrillary twitching of all the muscles in hands not amounting to athetosis.

Infantile Amaurotic Family Idiocy.

This peculiar condition has attracted considerable attention in recent years. In 1881 Tay, of England, described a case of symmetrical changes in the macula lutea. The child could not sit erect and was backward mentally. John Claiborne, reviewing this subject in 1900, refers to the above case, and says:—

"At the first examination the optic disc was normal, but at the macula there was a white, more or less round area, in the center of which was a brown spot. The picture was similar to that seen in embolism of the central artery of the retina. Tay at first thought it was a congenital change. Five months later he noticed the optic disc was atrophied. Three months later he observed 3 other cases in the same family. In all the ophthalmoscopic picture was the same, and all these persons died before the end of the second year of the disease. During the years 1885 and 1886 the same ophthalmoscopic picture was described by Magnus, Knapp, and others. In 1887 Sachs reported a case which impressed him as being one of idiocy; this was particularly interesting on account of the changes observed in the cortical cells. The family character of the affection was suggested to him after observing 4 cases in two families. Kingden, of England, published a case and showed a picture which eye surgeons said belonged to the disease which Sachs had elucidated. In 1898 Sachs reviewed the subject, tabulating 29 cases."

A. Jacobi reported 3 cases of this form of idiocy to the American Pediatric Society in 1898.

Pathology.—Sachs states that the external configuration of the brain exhibits a distinct picture of a lower order of development. It is difficult to state whether the changes were to be regarded as primary degenerations or due to an arrest in development.

Symptoms and Diagnosis.—There is "a milky-blue or white optic disc with bright cherry-red center occupying the place of the macula lutea." Nystagmus is frequently present. Hydrocephalus has been reported associated with this condition. The weakness of the extremities increases slowly until diplegia appears. In such cases the optic symptoms and idiocy are pronounced, and from these two conditions alone the diagnosis can be made. The voluntary muscles are relaxed, especially those of the abdomen. Death usually comes at the end of the second or third year, although the disease may last years. The child is totally blind.

Treatment.—No treatment has as yet modified or benefited these children.

Concussion of the Brain.

We frequently see children who have fallen down a flight of stairs, or with apparently as severe symptoms, will recover. The following case illustrates concussion of a *mild type* which recovered:—

Case I.—A boy, 7 years old, rolled down a flight of stairs. I saw him about one hour after his fall. There was nausea and vomiting. Some slight abrasions of the skin were present, and a scalp wound one inch in length which required a stitch. The temperature was 100° F. The boy was put to bed. I saw him about twelve hours later. He was perfectly normal and complained of intense hunger. On the following day the boy was apparently well.

Case II.—*Severe Concussion of the Brain.*—Child S. was seen by me through the courtesy of Dr. E. D. Lederman, with the following history: He was in his fourth year, bottle-fed during infancy, and excepting an occasional attack of dyspepsia, had always enjoyed good health.

Present Condition.—Three days before I saw him he fell and struck his head violently on the pavement. Six hours later severe vomiting set in. During the night following the fall he was feverish and moaned continually. On the following day when Dr. Lederman saw him the temperature was 103° F. The child seemed to be dazed and in a stupor at times. He was very thirsty. There were marked evidences of clonic and tonic spasms in the muscles of the body. A laxative was ordered. The gastro-intestinal tract was cleaned and an ice-bag applied to the head. These same symptoms continued, the fever rose to 105° F. and was not easily reduced. When I saw him in consultation with Dr. Lederman there were spastic conditions of the muscles of the arms and legs. There was marked rigidity of the spine. The sterno-cleido-mastoid muscles were rigid. There was marked opisthotonos. Severe photophobia. The pupils were dilated and did not respond to a strong light. The Babinski reflex was present on the right side, but not so positive on the left side. When moved about the child moaned as though in pain. A tache cérébrale was also present. The diagnosis of concussion and traumatic basilar meningitis was made.

A lumbar puncture was made and almost one-half ounce of turbid (milky) cerebrospinal fluid was withdrawn. The child passed urine involuntarily (evidently due to bladder paralysis). The case ended fatally.

INSOLATION (HEAT-STROKE: SUNSTROKE).

This condition is most frequently seen in midsummer. It sometimes occurs in perfectly healthy children who are exposed to the direct rays of the mid-day sun. I have frequently seen cases of sunstroke in *feeble children* who were playing in the shade. Children with lowered vitality and convalescents from some severe illness, such as diphtheria or pneumonia, are more prone to be affected by intense summer heat.

Pathology.—Intense cerebral hyperæmia and an intense engorgement of the veins throughout the body are the usual lesions seen in this condition.

Symptoms.—A child in apparently good health in midsummer will suddenly show intense fever. The temperature reaches as high as 104° or 105° F. in many instances. There is a corresponding increase in the pulse-rate. The pulse may be as high as 160 or 180. The face is usually flushed. The head is hot. There is a throbbing of the blood-vessels very apparent. The child may be unconscious and muscular twitchings may be noticed. In severe prostration there may be delirium and convulsions.

The pupils are usually contracted, although they may be dilated, and the eyes intensely congested. Sometimes vomiting and diarrhœa may accompany the symptoms above mentioned.

The following illustrates the manner in which heat-stroke occurs in New York City:—

A child will awaken in a normal condition, eat its breakfast and play as usual. After several hours hard playing and exposure to the sun's rays, the child will be exhausted. If a careless mother or nurse permits the child to continue its exposure to the direct midsummer heat, then prostration with the above noted symptoms will be noticed. In some cases brought to my clinic, the head is hot and the hands and feet are cold. If the sunstroke takes place soon after feeding, then violent gastric symptoms usually occur.

Prognosis.—The prognosis depends upon the vitality at the time of sunstroke. We must differentiate this condition from meningitis. The suddenness of the attack following exposure to the sun will usually aid in making a diagnosis. The majority of cases seen by me recovered. Occasionally a fatal case was encountered, especially in bottle-fed infants.

This infant (Fig. 283) brought to my clinic July, 1900, weighed 5 pounds 6 ounces. He was a bottle-fed infant, reared on condensed milk. He was nine weeks old. Vomited after each feeding, had greenish mucous, sour smelling stools, every half hour and oftener. There was eczema between the thighs from excoriation and acid stools. The child weighed 6 1/2 pounds at birth, and was a full-term baby.

The child was pulseless. The extremities were cold and covered with a clammy perspiration. The temperature was subnormal—97° F. The fontanel was depressed. The heart sounds were barely audible. The mouth, tongue, and lips were very dry; food and water were refused. Spirits of camphor, 5 drops, was injected hypodermically; a mustard foot-bath was ordered. The child died fifteen minutes later.

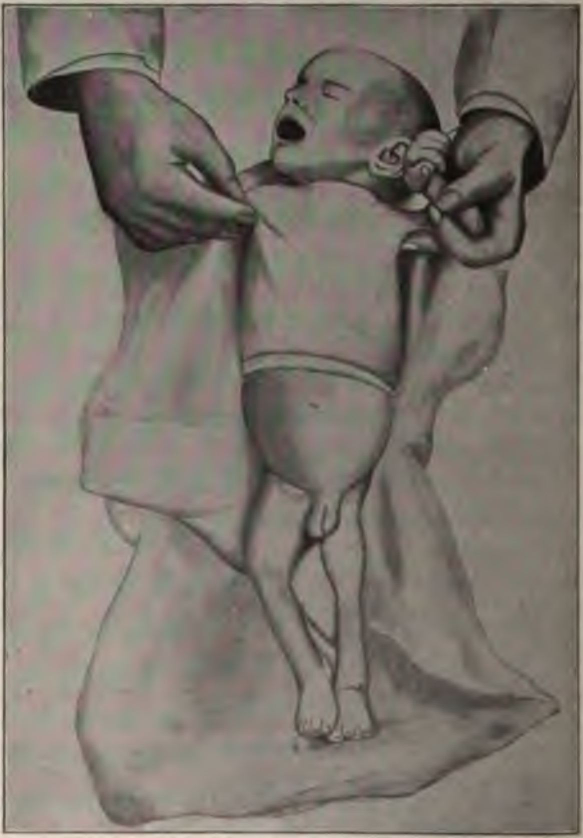


Fig. 283.—Insolation (Heat Stroke). Type of mid-summer cases in New York City. (Original.)

Diagnosis.—Cholera infantum, marasmus, due to malassimilation of food; improper food to commence with. *Extreme heat* caused heart failure and general prostration.

Treatment.—A tub-bath, temperature 90° F., gradually decreased to 70° F., duration five minutes, is advisable. An ice-bag should be applied to the head. If consciousness has been restored, the child should be allowed to rest; if not, then we can restore the circulation to relieve cerebral hyperæmia by giving a mustard foot-bath for several minutes until the skin is reddened. The rectum and colon should be flushed with a hot saline solution at a temperature of 110° F.; this will stimulate diuresis besides cleansing the bowel. One-drop doses of aromatic spirits of ammonia with water may be given every 15 minutes.

If the child can swallow then:—

℞	Bromide of sodium	10 grains
	Chloral hydrate	3 grains

should be given to a child 5 years old. This can be repeated every hour until a sedative effect is produced. In some cases (comatose) it may be advisable to inject per rectum:—

℞	Bromide of sodium	15 grains
	Starch water	1 ounce

Cold water should be given by mouth, with several drops of diluted hydrochloric acid. Peptonized milk, thin soups, and broths may be given every few hours. Liquid peptonoids can be tried if food is rejected.

PART X.

DISEASES OF THE EAR, EYE, SKIN, AND ABNORMAL GROWTHS.

CHAPTER I.

DISEASES OF THE EAR.

ACUTE CATARRHAL OTITIS MEDIA.

ACUTE catarrhal otitis media arises in the great majority of cases from extension of an inflammatory process by way of the Eustachian tube.

Etiology.—Burkens found 104 deaths in 33,107 ear cases, and Randall 15 in 5000, giving a percentage of three-tenths of 1 per cent. from intracranial disease.

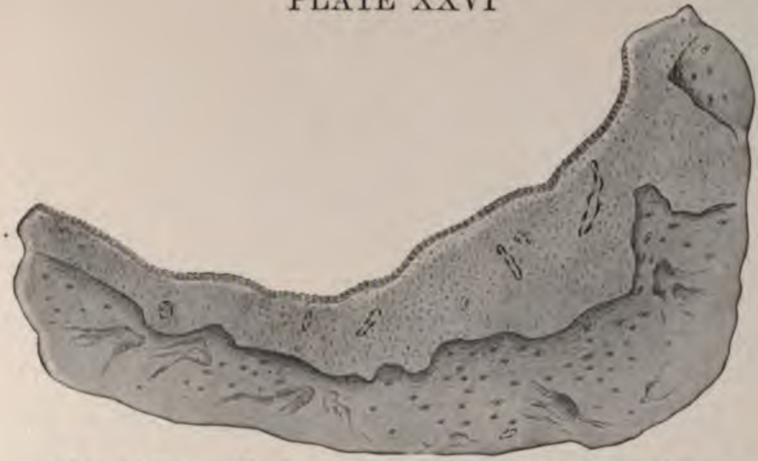
Schwartz records 30 deaths in 8425 ear cases, or 0.35 per cent. The death rate from purulent ear diseases, compared with all other diseases treated, was shown in Guy's Hospital, in London, some years ago, to be 57 deaths among 9000, two-thirds of 1 per cent; 40,073 autopsies in the Vienna General Hospital showed 232 deaths from otitic complications, *i.e.*, 0.58 per cent. The majority of these deaths occurred in the course of chronic suppuration of the middle ear, complications in the acute stage, with the exception of mastoiditis, being less frequent.

Naso-pharyngeal disease, especially the infectious diseases, such as measles, scarlet fever, influenza, and diphtheria, are frequently followed by otitis. The ease with which pathogenic bacteria can cause an inflammatory extension from the nose into the Eustachian tube is now recognized. Children of the lymphatic and rachitic types are more susceptible to these infections.

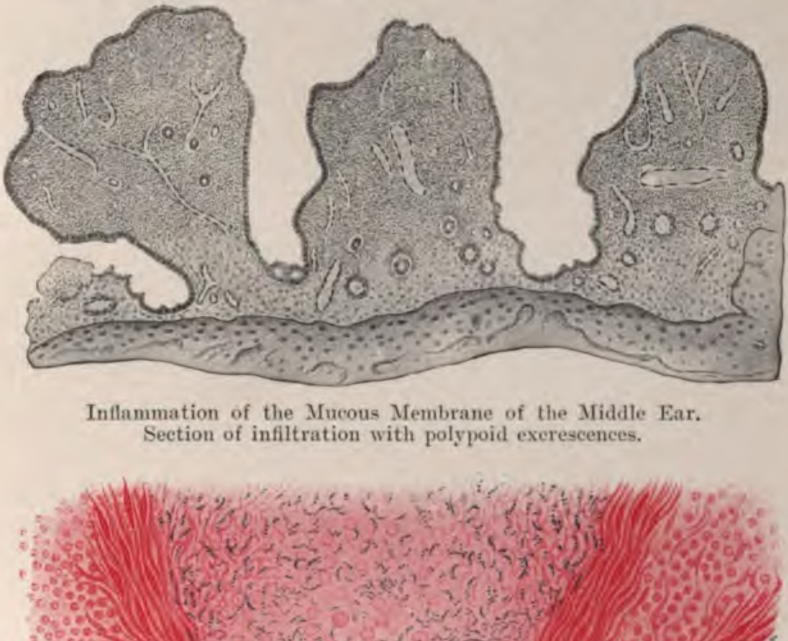
When a catarrhal process limits its attack to the lower portion of the middle ear chamber, the disease may run its course without becoming purulent. When, however, the upper part or tympanic attic is involved, we are more apt to find that the infection assumes a suppurative type. It is in this class of cases that complications arise and extension to the mastoid cells by way of the aditus soon follows.

Bacteriology.—Observers have found that even in the normal tympanic cavity, pathogenic bacteria exist. Consequently any deviation from the normal process in this region predisposes the individual to a purulent infection. A passive congestion of the tympanic mucous membrane due to

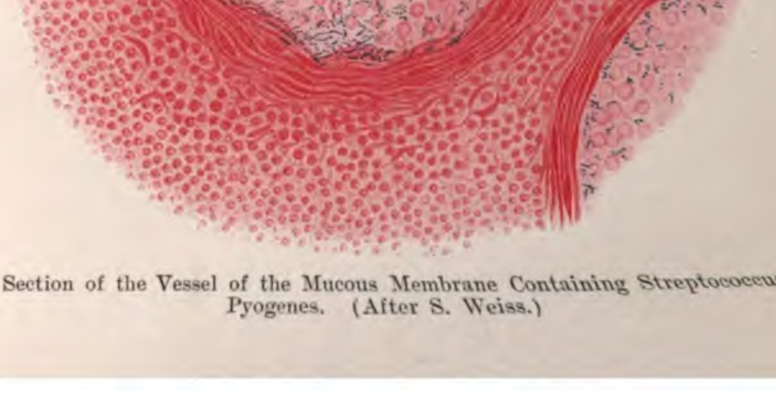
PLATE XXVI



Normal Mucous Membrane of the Middle Ear in the New-born.



Inflammation of the Mucous Membrane of the Middle Ear.
Section of infiltration with polypoid exerescences.



Section of the Vessel of the Mucous Membrane Containing Streptococcus Pyogenes. (After S. Weiss.)

cardiac, renal, naso, or naso-pharyngeal disease, must be considered a potent factor in the production of a suppurative otitis. Staphylococci, diplococci, and streptococci have been found in the naso-pharyngeal space, and it is reasonable to suppose that these micro-organisms are apt to find their way into the Eustachian tube and tympanitic cavity even under normal conditions.

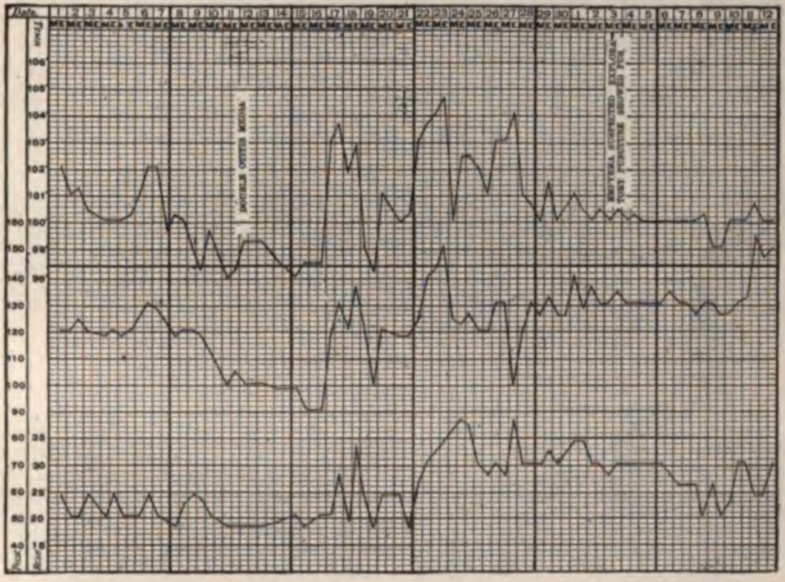


Fig. 284.—Complication of Scarlet Fever seen in my service at Riverside Hospital. (Original.)

A study of this case, in which both ears were discharging, is interesting. The temperature was only $99\,{}^{2}/_{5}$° F. in the rectum. This proves that we must always be on the lookout for suppuration of the middle ear in the acute infectious diseases.

Pathology.—We must bear in mind that the ossicular chain is surrounded or enveloped by folds of mucous membrane, and when this tissue becomes engorged drainage from the attic is difficult. Consequently our incisions through the upper and posterior portion of the membrane in acute otitis should be deliberate and somewhat heroic, otherwise we will not accomplish the object in view, *i.e.,* drainage from that portion of the middle ear which is most likely to be followed by disease of the mastoid antrum and cells.

Symptoms.—Two prominent symptoms are always present; one is pain and the other fever. The infant is usually very restless, rolling the head from side to side on the pillow and rubbing the hand over the affected ear. At times the nose and throat will also be inflamed. Local tenderness can usually be made out on pressure. The examination of the middle ear with the speculum should always be made by one skilled in this work.

Symptoms of meningitis are frequently present and will disappear when proper treatment for an otitis is instituted. I have frequently seen a case of persistent high fever, during the course of a scarlet fever, suddenly improve after the drum-membrane was incised. The temperature ranges between 100° and 105° F. A distinct rise of temperature does not always accompany this condition as is usual in other inflammatory conditions.

Diagnosis.—This is easily made by one skilled in examining the ears. When a doubt exists the safer plan is to call in an aurist for an opinion. The neglect of this precaution may prove a serious matter, as deafness may follow.

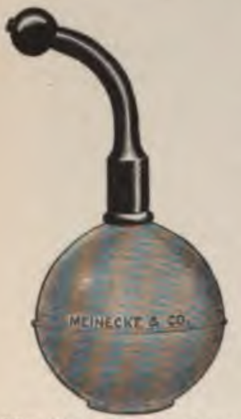


Fig. 285.—Ear Syringe.

Prognosis.—The prognosis is reasonably good. We must not be too positive in giving a good prognosis, as sometimes fatal results follow the extension of the inflammatory condition from the middle ear into the brain.

Treatment.—Prompt drainage by an early incision through the bulging membrane is the treatment indicated. To further drainage under such conditions it is wise to douche the ear with hot antiseptic solutions at a temperature of 108° to 120° F., using a return flow cannula. It has been claimed that the higher the temperature of the douche, the greater the possibility of absorbing the threatening mastoiditis.

Prophylactic Treatment.—As a soothing and prophylactic agent after incision or even before surgical intervention is indicated, a carbolized glycerine solution acts well in a number of these cases. In a very young child a 2 per cent. solution may be instilled into the ear after the same has been cleansed with a douche, every two hours. This may be increased in strength as the age of the patient progresses. Oily combinations should never be used as local agents in aural disease. They are apt to become rancid, and as the middle ear is an excellent incubator, affording bacteria, plenty of heat and moisture, infection rapidly occurs.

General Treatment.—Peroxide of hydrogen or dioxygen is a valuable cleanser and deodorizer when the perforation of the membrane is large. The same remedy may cause extension of a purulent otitis if the aperture in the drum is small, and the liberation of its oxygen causes sufficient pressure to force the purulent foci backward through the aditus. Bulging of the upper portion of the membrane with a protrusion of the superior and posterior walls of the external auditory meatus, together with tenderness over the mastoid antrum or tip, with some elevation of temperature, occurring during the course of an acute otitis, are indicative symptoms of mastoid involvement. Extensive disease of the mastoid cells may exist without the slightest rise in temperature, especially if the acute stage of the inflammatory process has passed by.

We may safely assume that in all cases of catarrhal otitis the mucous membrane lining the mastoid antrum is involved simultaneously with that of the middle ear, as it is part of the same tissue. For this reason blood-letting, done under aseptic precautions, should be carried out as near the cavity as possible; therefore, an internal Wilde's incision carried through the posterior superior quadrant of the membrane is certainly a rational procedure.

Restorative treatment such as iron, codliver-oil, Fowler's solution, besides concentrated foods, must be remembered. Unless we assist the nutrition of the body we cannot expect to cure the disease. If the symptoms increase in severity and the temperature persists, the dangers associated with mastoiditis must be remembered, and the skill of an otologist or a surgeon will be required.

MASTOID OPERATION ON INFANTS AND CHILDREN.

In operating on infants and children it is important to remember certain points wherein they differ from adults. These briefly mentioned are the following:—

At birth, in the mastoid the antrum exists as the only cavity, about the size of a small pea; the process is not formed until after the end of the first year, and the pneumatic spaces not until puberty.

There are also frequently dehiscences filled with fibro-cartilage as the squamo-mastoid suture is not ossified at birth. So when making the primary incision, the knife must be used gently until the periosteum is reached, and this likewise must be raised with the greatest care to prevent, in such cases, the instruments slipping into the cranial cavity.

In curetting after opening the mastoid, it must be borne in mind that the bone tissue in childhood is soft, so that healthy tissue need not be sacrificed unnecessarily.

The Operation.—During the operation, strict antisepsis must be observed. The space around the mastoid for two or three inches beyond should be shaved and made surgically clean. The auditory canal should be irrigated with a bichloride solution of 1 to 1000. Then under complete anæsthesia, with a scalpel, curvilinear incision should be made from end of the mastoid close to the insertion of the auricle to about one-half inch of its upper border, down to the periosteum. This is then separated.

The bleeding is controlled either by clamping vessels, or with gauze wrung out of hot water. An Allport retractor or one of its modifications should then be used, which not only answers the purpose of its name, but also stops the oozing. The parts should be separated with the auricle held forward so that the posterior and superior walls of the auditory canal and the whole field of operation is exposed to view.

If the bone is bathed in pus this is wiped away and any perforation is examined with a probe. The opening is enlarged, either with a spoon or rongeur. Should no perforation or sinus exist, then the antrum should be opened either with a flat chisel or gouge and a mallet. The suprameatal triangle is above the antrum. This is made by drawing one line horizontally with the superior border of the auditory canal, a second vertical one with the posterior, and a base line corresponding with the curvilinear line between these points.

The chisel should be used gently and tangential, and the bone chipped away in small sections, always working downward, forward, and inward. A probe should be used to determine from time to time whether the antrum has been entered, and also to examine the cavity made.

As soon as an opening has been made, a rongeur should be used to enlarge it, and then thoroughly cleaned out with a Volkman's spoon. The space leading from the antrum to the roof of the tympanum, that is, the aditus and attic, should be carefully cleaned out with a small curette. The antrum should then be carefully extended backward until the lateral sinus is exposed and inspected as to whether its appearance is healthy. Its presence can be determined by its bluish appearance and the soft feel to the probe. All granulations and soft tissue having been cleaned out, the parts are gently irrigated with a bichloride solution of 1 to 5000, normal salt solution, saturated solution of boric acid, or sterile water if considered necessary. The wound is then wiped dry, the upper and lower ends can be stitched together, and the rest packed somewhat lightly with iodoform gauze. Bury this gauze; that is, do not let it project; then over this draw the parts together and apply layers of sterile gauze, absorbent cotton, and a bandage.

After-treatment.—Unless pain or a rise in temperature occurs, it is frequently not necessary to change the dressing for five or six days. Usually there is no discharge in the auditory canal; if there is, it is gently irrigated or wiped out. For the mastoid wound, a dry wiping is all that is necessary usually, and a dressing of sterile gauze used lightly packed. This can be changed every two or three days. Granulation tissue of course must be cauterized.

Accidents During the Operation.—*Wounding the lateral sinus* may cause a profuse hæmorrhage. If the bony cortex has been sufficiently removed, the sinus may be plugged with iodoform gauze and the operation completed. The sinus whenever exposed should be kept covered with iodoform gauze separate from the rest of the cavity to prevent infection. If the vessel should not be sufficiently freed from the bony covering, the bleeding may prevent the completion of the operation.

Exposure of the Dura.—If carefully dealt with, this is not a matter of much importance, if the part is kept covered with iodoform gauze independent of the rest of the wound. If the dura should be wounded it should be opened, cleaned, and sewed up with fine catgut sutures.

Facial Paralysis.—In operating, this condition can be prevented by not interfering with the lower two-thirds of the posterior wall of the auditory canal and the facial nerve will escape injury. Where it has been slightly injured, the function of the nerve is usually restored within four to six weeks.

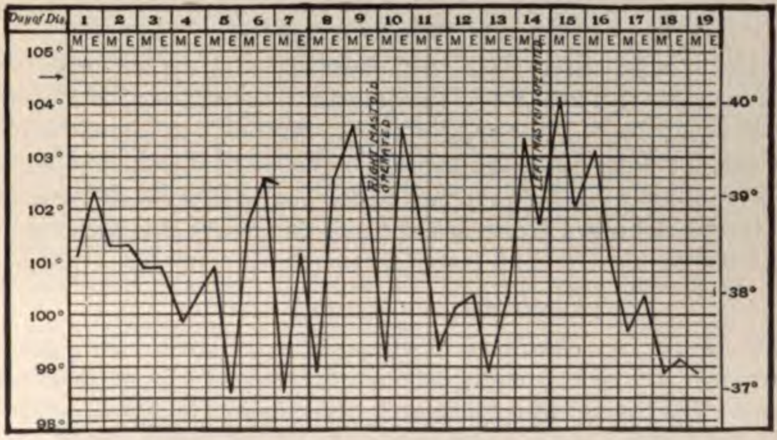


Fig. 286.—A Common Type of Acute Mastoid Inflammation Following Influenza. There was a double otitis before the extension to the mastoid cells. Note the fever curve following the operations. Case recovered. (Original.)

Francis M. C., 1 year old, suffered with gastric disturbance, poor appetite and symptoms resembling colic. His bowels moved sluggishly, the stool was greenish and contained mucus and undigested particles of casein. He emaciated owing to the non-assimilation of food. From the history I learned, that the child has had fever accompanied by catarrh of the nose and a general bronchitis for the last four weeks. The examination of the body showed a decidedly rachitic thorax and distended abdomen; retarded dentition and general backwardness in development. There was no evidence of pulmonary disease. The heart-sounds were feeble and a hæmic murmur was distinctly heard at the apex of the heart and also in the vessels of the neck. The child perspired very freely. The temperature was 102.4° F., pulse 140, respiration 28. The throat showed enlarged tonsils and also adenoid vegetations. This latter condition was reported by Dr. Charles D. Manson. Both ears were discharging. The child was very restless, moaned and fretted continually and did not sleep at night. My diagnosis was influenza, subacute gastric catarrh, rachitis, and mastoid involvement. Dr. Edward Dench saw this case at my request and corroborated the diagnosis. The temperature rose to 103.6° F. The right mastoid was opened by Dr. Dench at the New York Ear and Eye Infirmary. The temperature came down by lysis to normal. Three days later, while the child was doing quite well, the temperature again rose to 103.6° F. A left mastoid was suspected, and accordingly the second operation was performed. On the day following the operation the temperature rose to 104.2° F., and an acute milk infection was suspected. With the aid of mist. rhei et sodii and a diet of whey only, at intervals of three or four hours, the stomach symptoms subsided, and four days later the child was removed from the hospital to its home in a normal condition. With careful asepsis both wounds healed. The child gained in weight and within one month had entirely recovered.

FOREIGN BODIES IN THE EAR.

Insects, bugs, cotton, beads, and pieces of pencil are frequently found in the meatus. When beans or peas remain they swell and cause painful pressure symptoms. The specialist should invariably be consulted rather than risk the danger of traumatism in unsuccessful attempts at removal. If a live insect or bug is in the middle ear, pour water, oil, or alcohol into the ear. If the insect is not dislodged by this means try Allen's foreign body forceps.

THROMBOSIS OF CEREBRAL SINUSES.

There are two conditions usually seen in children; first, *primary*, where there is a general malassimilation of food, such as we find in marasmus. This is also called marasmic thrombosis. *Second*, a secondary condition due to a local disease, such as injury to the bone or ear.

Primary thrombosis is confined to the superior longitudinal sinus.

Symptoms.—Œdema of the scalp on the side of the head and forehead. At times there is epistaxis. The fontanel is usually bulging or distended. If the clot extends into the internal jugular then the external jugular will be overfull and the thromboid vein can be felt as a very hard band.

Secondary Thrombosis.—This is usually due to suppurative otitis media. It usually affects the lateral sinus. It may also follow suppuration in the eyes or nose, or follow erysipelas.

Cavernous sinus may result from the lateral or petrosal sinuses. It may be due to extension from the ophthalmic veins, such as is found in phlegmonous inflammation within the orbit.

The special symptoms are exophthalmia, ptosis, œdema of the lids and of the root of the nose, also paralysis of the sixth and other ocular nerves.

Thrombosis of the *veins of Galen*, leading to effusion into the ventricles, has occurred as a fatal complication of scarlet fever. "The thrombosis may be brought about by direct extension from the inflamed bone, or by extension by accretion of a septic clot from the veins of the mastoid cells, which open into the lateral sinus."

CHAPTER II.

DISEASES OF THE EYE.[1]

ACUTE CATARRHAL CONJUNCTIVITIS.

THIS condition is usually associated with infectious diseases. As a rule it is found in coryza, the acute exanthemata, influenza, and the usual infections due to pathogenic bacteria in the atmosphere.

General Plan of Cleaning the Eye when Secretion Exists.—The eyes should be thoroughly cleansed with a pledget of cotton dipped in lukewarm water. Then use a drop or two of a solution of cocaine:—

℞ Cocaine hydrochlorate	10 grains
Salicylic acid	½ grain
Distilled water	1 ounce

M. Drop into the eye 3 times a day.

After instilling the cocaine, a few drops of a 2 per cent. argyrol solution should be dropped on the eyelid. The irritating secretions should be wiped away as frequently as possible. A weak solution of bichloride of mercury, 1 to 5000, applied on cotton, will best serve to cleanse the eye. It should be used at a temperature of 100° F., hourly if necessary.

A solution of borax:—

℞ Biborate of soda	4 parts
Distilled water	100 parts

Or:—

℞ Argyrol	1 part
Distilled water	100 parts

are very good cleansing remedies.

Peroxide of hydrogen,[2] one-half strength, is recommended by Stephenson, to be used three times a day.

Atropia is simply mentioned to be condemned. Protargol and largin stain the conjunctiva and are useless. To prevent the lids from gluing together the yellow oxide of mercury ointment should be applied two or three times a day —

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[1] The correction of Errors of Refraction, such as astigmatism by means of eye-glasses, and the treatment of strabismus, should only be undertaken by the specialist. The reader is referred to special works on Diseases of the Eye for particulars regarding these conditions.

[2] A good preparation on the market is called dioxygen.

℞ Yellow oxide of mercury, 5 per cent.	1 part
Vaseline	10 parts
Lanoline	10 parts

PINK EYE.

This form of acute ophthalmia is similar to the one just described. It is very communicable and most probably transmits infection by a specific organism.

Weeks[1] was the first to describe a definite micro-organism causing the disease. The Weeks bacillus is short and has rounded ends. It stains very easily with methylene blue. It is intensely contagious and spreads rapidly, especially in schools. Children under fifteen years are especially susceptible.

The diplo-bacillus of Morax was described by him in June, 1896, in the Annales de l'Institut Pasteur. The inflammation is frequently due to the presence of the diplo-bacillus. The inflammation usually begins in one eye and infects the other a few days later. Its course may be either chronic or acute.

PNEUMOCOCCUS OPHTHALMIA.

This disease is frequently seen in new-born children in which the lachrymal sac suffers.

Gifford[2] described an epidemic in Omaha where several distinct outbreaks took place within a few years.

Veasey[3] states that the pneumococcus is the most frequent cause of ophthalmia in Philadelphia. The bacteriological examinations of the organisms are very easily made. A cover glass smeared with the pus, stains well with methylene blue. Under the microscope there are diplococci, cocci, and chains devoid of capsule.

Infection of the conjunctiva sometimes occurs. This is frequently the result of impetigo contagiosa of the face or scalp. Infected secretions transmitted to the eye by the fingers usually set up this inflammation. Little girls frequently transmit vaginal discharges on their fingers and thus cause infection. The common cocci of suppuration, namely, staphylococcus pyogenes aureus, albus, and citreus, are usually found in this discharge.

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[1] Archives of Ophthalmology, 1886, No. 4, p. 441.

[2] Gifford: Archives of Ophthalmology, vol. xxv, 1896, p. 314.

[3] Veasey: Archives of Ophthalmology, vol. xxxviii, 1899, p. 301.

Treatment.—Clean the eye by dipping small pledgets of absorbent cotton into lukewarm water, or dip the cotton into a 2 per cent. solution of borax. A medicine dropper can be filled three or four times with a solution of:—

℞ Formalin[1] .... 1 to 2000

Sig.: Wash or bathe the eye with this formalin solution every four hours.

Very hot water applied on pledgets of sterilized cheese-cloth will reduce the inflammation of the lids. In other cases, cold lead and opium wash will be very soothing and have a similar effect. We can prevent the lids from sticking together by applying vaseline at night.

Purulent Ophthalmia (Ophthalmia Neonatorum).

This is a purulent conjunctivitis of the new-born infant. It may be seen several hours, or sometimes appears several days, after birth. The amount of pus secreted is very large. When the lids are separated pus will be liberated.

Etiology.—It is usually caused by an infection in the maternal passages containing the gonococcus during labor. The pneumococcus has also been found in some cases. These pathogenic bacteria are carried directly into the eye, either by the secretions or by means of infected sponges or towels. Bacteriology has proven that all causes excepting distinct germ infection must be eradicated.

Symptoms.—The lids appear red and swollen. The upper lid frequently overhangs the lower and the infant is unable to open the eyes. Stephenson states that 10 per cent. of children so affected remain totally blind. Of 446 cases of ophthalmia occurring in the practice of seven physicians quoted by Stephenson, gonococci was found in 72.83 per cent. In Stephenson's own cases, out of 45 affected, 30 showed evidence of the gonococci, or 66.5 per cent.

Preventive Treatment.—The Credé method is now universally used. As soon as the infant is born and the face wiped clean, the following solution is dropped into the eye:—

℞ Nitrate of silver solution............................ 2 per cent.

Sig.: It is best to let it fall from a medicine dropper on the eyeball. A slight inflammatory reaction is occasionally seen and if treated with a cold solution of formalin, 1 to 2000, disappears quickly.

Membranous Conjunctivitis (Diphtheritic Conjunctivitis).

We occasionally see membranous patches on the surface of the conjunctiva. This membranous deposit is sometimes distinctly diphtheritic, a culture taken showing the presence of the Klebs-Loeffler bacillus. To differentiate clinically between the diphtheritic and non-diphtheritic type is sometimes impossible. I have seen membranous conjunctivitis at the Willard Parker Hospital in which the disease clinically resembled diphtheria and still the Klebs-Loeffler bacillus was absent. In one case seen by me the streptococcus alone was present. The clinical history of the case is an important guide in the diagnosis. If another case of diphtheria exists at the same time in the same house, the question of transmission should have weight in making the diagnosis. Every case of membranous conjunctivitis requires a careful inspection of the fauces. If croupous laryngitis is present, then a greater probability of diphtheria is warranted.

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[1] Formalin is a 45 per cent. solution of formaldehyde. Formaldehyde itself is a gas and a strong escharotic.

Symptoms.—A grayish-yellow patch can be seen on the conjunctiva. The lids are very tender and swollen. They feel hard and thick on palpation, and cannot be everted. Ulceration or sphacelation of the cornea usually follows. The same systemic disturbances may be noted as are found in diphtheria affecting the throat. There is usually fever, glandular enlargement, loss of appetite, general prostration, and cardiac disturbances, as has been described in the chapter on "Diphtheria."

Prognosis.—A very guarded prognosis is necessary, as the outcome of the case depends upon the care bestowed and the time when the case was first seen. If the disease has been established a long time, a greater destructive tendency must be presumed than if the case was seen when it first originated.

Treatment.—First isolate. The communicable nature of this disease must be remembered. The family and friends should be warned of the danger.

Local Treatment.—If the eyes are thick and swollen, an ice-bag or ice-cold pledgets of cotton soaked in bichloride, 1 to 2000, should be applied. They should be renewed every five to ten minutes night and day, to produce a good result. In other cases warm, moist applications will alleviate pain and also reduce inflammation.

Specific Treatment.—Diphtheria is diphtheria whether it is in the eye or in the throat, hence an injection of 5000 units of antitoxin should be given regardless of the age of the child. The same internal treatment which is described in the chapter on "Diphtheria" is recommended if we desire successful results in these cases.

GRANULAR OPHTHALMIA (TRACHOMA).

The characteristic feature lies in the development on the palpebral conjunctiva of the so-called "sago grains."

Granular lids must be carefully considered owing to their disastrous tendency.

The following table, slightly modified from Stephenson ("Epidemic Ophthalmia," 1895) gives the differential diagnosis between folliculosis of the conjunctiva and trachoma:—

TABLE No. 105.

FALSE OR FOLLICULAR GRANULATION.	TRACHOMA.
1. Oval or roundish transparent bodies the diameter of which never exceeds from 1 millimeter to 1 $^1/_2$ millimeters. Of a faint yellowish hue, arranged in rows parallel to the lid border, and discrete. Most marked in inferior retrotarsal fold.	1. Round, opaque, ill-defined bodies, of grayish-white color and extreme friability. Firmly and deeply embedded in the conjunctiva, their diameter not infrequently reaches 2 millimeters or more. Tendency to become confluent and form masses or areas of trachomatous material. Most numerous and larger in upper retrotarsal fold.
2. Little or no change in the structure of the conjunctiva.	2. Structural changes always present.
3. Papillary hypertrophy of upper lid slight.	3. Marked hypertrophied papillæ of upper lid generally present.
4. Tarsus never implicated.	4. Tarsus often involved.
5. Disappear spontaneously generally and leave no scar.	5. Spontaneous cure may occur, but only by cicatrization, which may be slight or extensive according to the amount of tissue involved.
6. No ptosis.	6. Ptosis nearly always present in some degree.
7. No pannus.	7. Keratitis in the form of pannus or ulcer in about 25 per cent. of the cases.
8. No trichiasis, entropion, or cicatricial contraction of the cul-de-sac.	8. Frequently leads to trichiasis, entropion, or shrinking of the cul-de-sac.
9. Most frequent in persons under 20 years.	9. May occur at any age.
10. Non-contagious.	10. Conditionally contagious.

This disease may frequently assume an epidemic nature. During the last two years hundreds of cases have suddenly appeared in our city. The ease with which all infectious diseases spread in the congested portions of our city applies to trachoma. For this reason school-children and inmates of institutions and hospitals should have the eyes carefully inspected on admission to exclude trachoma. In our country the native American Indian suffers from this disease, so do the Irish, Polish, Italians, and the Teutonic races. It is therefore quite probable that this disease is spread more or less among all races. One race is exempt, namely, the negro.

Treatment.—Of all methods, *expression* is the method generally used. The morbid tissue is thereby dislodged and removed. Actual cauterization, galvano-cautery, or the solid nitrate of silver stick is mentioned by some, but should be used only by those familiar with the eye. The advice that I give in my office to patients suffering with trachoma, is to recommend them to an eye specialist.

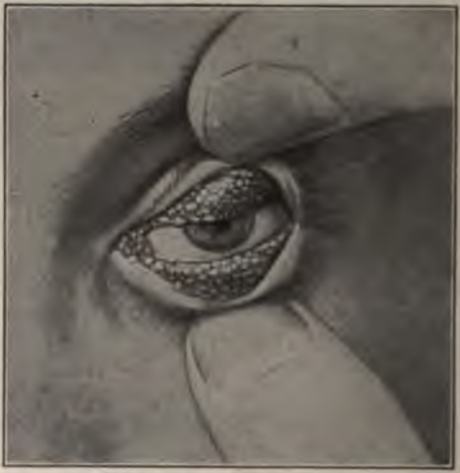

Fig. 287.—Trachoma, Showing Round, Opaque Bodies in Upper and Lower Lids. "Sago grain" type. From a photograph—frequent type seen in children. (Original.)

BLEPHARITIS.

This disease is characterized by a sub-acute or chronic inflammation along the margin of the lids.

Two classes of cases might be noted. *First*, those in which slight crusts appear on the edges which, when cleared off, show no loss of substance; simply reddened margin. This would include the cases of marginal eczema, so called. *Second*, those cases which, when cleared of crusts, show ulceration.

The first class of cases seek treatment for cosmetic results. There is no pain, only a slight discomfort exists. These cases are all aggravated by exposure to dust, wind, heat, or long spells of work.

The second class of cases is more serious. At first they present a dusky margin and gluing together of eyelashes, due to excessive secretion, which gradually progresses. Beneath the crusts ulcers form. Excoriations and pustules about the hair follicles interfere with the growth, so that the lashes fall out or become stunted. The vascularity continues, increasing the thickness of the lids with new connective tissue. The gradual contraction of this new scar tissue leads to eversion of the lids with resulting epiphora, or overflow of tears, presenting a disagreeable, raw-looking surface.

Treatment.—Generally speaking, the treatment consists of removing the crusts or scabs by any warm alkaline lotion, such as bicarbonate of soda, or biborate of soda, 10 to 20 grains; aquæ, 1 ounce. Massage of the lids with red or yellow oxide or white precipitate, 2 to 8 grains; vaseline, 1 ounce, should follow.

A mild ointment should be used—a strong one increases the irritation. All refractive errors must be corrected. Epilation of the lashes sometimes promotes a cure when commenced in the early stages of the disease. The general condition of the patient must be looked after, and iron, arsenic, codliver-oil, or similar tonics and hygienic treatment as indicated should be prescribed.

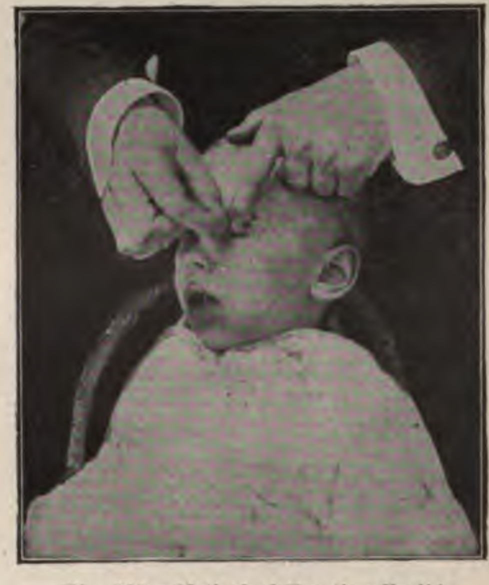

Fig. 288.—Method of Everting Eyelid. (After Davis and Douglass.)

HORDEOLUM, OR STYE.

This disease is characterized by an inflammation of the connective tissue about a hair follicle along the lid margin. A hard, circumscribed, inflammatory nodule forms, which may suppurate. Occasionally, it remains as a hard lump, and still in other cases the lid becomes swollen and œdematous. A close examination, however, will show the inflammatory spot, which as soon as it appears yellowish should be incised and the pus evacuated.

Treatment.—The general treatment consists in hot applications to favor resolution. To prevent successive crops, the massaging of the lids with an ointment of hydrarg. ox. flav., $^1/_2$ to 2 grains; vaseline, 2 drachms, has an excellent effect. The infection from the pus may be prevented by the use of argyrol in a 5 per cent. solution, one drop two or three times daily.

These successive styes show some disease of the lid margin, as blepharitis, some derangement of the general system, or eye-strain, especially in hypermetropia.

PHLYCTENULAR CONJUNCTIVITIS.

This affection is one of childhood and is seen in malnutrition after the acute exanthemata; also in marasmic or scrofulous children.

Small elevated spots, papules, or pustules the size of a mustard seed are found in this condition. When the epithelial covering is shed they become superficial ulcers. They are either single or multiple, and appear as pinkish, yellowish, or grayish spots. There is very often a great dread of light—photophobia—which leads to spasms of the lids—blepharospasm. There are also at times pain, burning sensation, and lachrymation.

Treatment.—*Local treatment* consists of bathing with a saturated solution of boric acid. If any excoriation exists at outer canthus, touching it with nitrate of silver generally effects a cure.

If the symptoms show that the condition is subacute or chronic then stimulating applications are required, as:—

℞ Hydrarg. ox flav. .... 4 to 8 grains
Vaseline .... 1 ounce

M. and apply three times a day.

I have had excellent results by touching the affected parts lightly with a solid stick of alum or copper.

If there is much corneal involvement:—

℞ Atropin sulph....................................... $^1/_2$ grain
Aq. dest... 2 drachms

Sig.: One drop in the eye once or twice daily may have to be used.

For the blepharospasm, a forced opening of the lids, an occasional drop of a 2 per cent. solution of cocaine, or a sudden plunging of the head in cold water will relieve the condition.

General Treatment.—This consists in the hygienic care of the child and tonic treatment. The eyes should be kept clean and open, dark glasses should be worn if necessary. No dark room, bandages, or eye shields should be allowed. The bowels should be regulated. The diet should be looked into. All sweets interdicted, meat given occasionally, and milk foods ordered. Give plenty of fresh air, outdoor exercise, and bathing. Tonics, such as codliver-oil, syr. ferri iodide, strychnine, etc., should be given.

CHAPTER III.

DISEASES OF THE SKIN.

ECZEMA.

THIS eruptive disease is very frequently seen in infants as well as in older children.

Etiology.—Irritation, be it an irritant soap or an irritant discharge, can give rise to eczema. Eczema is frequently an external manifestation of toxic conditions. The frequency with which eczema is seen in children with dyspeptic conditions certainly invites consideration. Children having rickets are frequent sufferers with eczema. Some authors believe that *pathogenic bacteria can enter the skin and set up eczema.* While this appears plausible, it remains to be proven. It is found associated with deficient elimination from the skin in the unclean, in dyspeptic conditions when the stomach and bowels are not properly functionating, and also when the kidneys do not properly act. I have frequently seen children with a facial eczema which appeared when oatmeal was given and disappeared when the same was stopped. Eczema may be due to reflex irritation. Holt says that cases which accompany dentition and those due to genital irritation can be called reflex.

This disease can be either *localized (regional)*, as when it is confined to the face or between the thighs, or it can be *general* or *universal.*

Symptoms.—There is always an intense itching or burning with the appearance of the eczema. On the cheeks it usually begins with "small red papules, later these coalesce and there is a moist red surface exuding serum or sero-pus." Children scratch and thus usually produce bloody streaks. The crusts have a yellowish-brown appearance. There is a redness, thickening, and always scaliness of the skin. The glands in the immediate neighborhood are usually swollen; they rarely lead to suppuration.

Eczema frequently spreads from the face to the forehead and the neck, and I have seen it involve the whole head.

Infant G. S., seven months old, was nursed about six weeks at his mother's breast. He was then fed on top milk and barley water. As this disagreed he was given barley water. He then had dyspeptic, greenish stools, and the feeding was changed to milk and rice water, which seemed to agree quite well. He gained steadily one-half pound every week for the next three months. He was at the seashore all summer and had no evidence of summer complaint. When seven months old he was slightly constipated and with it had dyspeptic fermentation. His appetite was poor. It was necessary to stimulate the bowels to produce proper evacuations.

Teething appeared at about the eighth month. At the same time the child had a severe attack of influenza of the gastric type, with high fever, anorexia, and gastro-intestinal atony. At this time a scaly and papular eczema appeared on one cheek and rapidly spread to both cheeks. With the application of a bland ointment consisting of zinc oxide and vaseline it disappeared. One week later I again saw this child with a relapse of high fever and dyspeptic symptoms, and a severe eczema covering an area larger than before. It was very red and angry looking and weeping in character. A gauze mask saturated with calamine and zinc lotion (3 per cent.) produced a marked improvement, besides relieving the itching. Internally I gave rhubarb and soda tablets in addition to cutting down the quantity of milk one-half of the previous strength. After three weeks of this form of treatment I was able to return to the former full milk feeding and the eczema did not return.

The following prescriptions are valuable:—

CALAMINE LOTION.

℞ Pulv. calamini	2 parts
Pulv. zinci ox.	2 parts
Glycerini	1 part
Aq. rosæ	30 parts

UNNA'S SOFT ZINC PASTE.

℞ Ol. lini,
Aq. calcis,
Zinci ox.,
Cretæ .... of each, equal parts

Treatment.—Bland unirritating applications, such as rice powder, zinc oxide, stearate of zinc, talcum, or cornstarch, are very cooling, and seem to act by absorbing the heat and moisture if any be present.

Bathing in Eczema.—I have frequently found an apparently cured case of eczema break out anew with a red blush and eczematous patches after one ordinary cleansing bath was given. In the acute stages ***water should be omitted.*** Applications of a 5 or 10 per cent. calamine and zinc salve or lotion, as described in the clinical case above given, are very beneficial. Soap should never be used. When hard crusts cover the surface of the skin and cannot be softened by the ordinary application of salves, the following treatment should be instituted: A bland bath consisting of one pound of oatmeal in a cheese-cloth bag, should be thoroughly soaked in hot water for at least one-half hour, and enough water added to bathe the eczematous parts. After thorough soaking in this oatmeal bath the calamine and zinc or a 2 per cent. boric acid and vaseline ointment should be applied. *One bath only should be given.* The salve should be applied three times a day for at least one week. Irritating ointments, or those containing tar, should be avoided in the acute condition.

Eczema Rubrum.

The eczematous blush affecting the face may be mistaken for erysipelas. Erysipelas usually occupies a smaller area, generally on the bridge of the nose. High fever usually accompanies erysipelas; this will easily differentiate the condition. The treatment is the same as that outlined in the article on "Eczema."

SALICYLIC-SULPHUR PASTE.

℞ Ac. salicyl.	1 part
Sulph. depur.	5 parts
Petrolatum	25 parts
Zinci oxid.	10 parts
Amylum	10 parts

ICHTHYOL OINTMENT.

Ammon. sulph-ichthyolat.	5 parts
Ap. dest.	5 parts
Adeps benzoat.	15 parts
Adeps lanæ	25 parts

ECZEMA INTERTRIGO.

In fat children where two opposing surfaces of skin are in contact, such as between the thighs or toes or in the armpits, a red form of inflammation frequently ensues. It is sometimes accompanied by a thin, foul-smelling discharge, which may be serous, but very rarely is purulent. This condition is more apt to be noticed in the unclean.

Treatment. — Remove the cause by separating the parts. Sprinkle freely with talcum, zinc oxide, lycopodium, Fuller's earth, or any good infant's powder. In severe cases separate the parts by placing a sterile pad of cheese-cloth on both sides of which zinc salve is smeared. All warm clothing should be avoided. When severe excoriation results from discharges and is not checked by the application of bland salves, then cool lead and opium wash applied for a day or more is soothing and will reduce the inflammation.

ERYTHEMA.

Local irritation such as might be caused by a mustard plaster or the friction of a dress, producing a "chafe," or irritating secretions, such as a purulent ophthalmia or acrid discharge from the nose, produces this erythema. It is frequently seen in infants on the buttocks from lack of cleanliness. When seen on the buttocks it may be mistaken for syphilis. Erythema is easily differentiated from syphilis by the absence of snuffling of the nose, of the ham-colored eruption, and of the inelastic cracked appearance of the soles and palms.

URTICARIA (HIVES: NETTLE RASH).

This inflammatory condition of the skin appears very suddenly. No special portion of the body is exempt; thus, it may occur on the face, abdomen, or extremities. It consists of irregular shaped blotches called *wheals*. When these spots disappear they leave no trace behind. There are several varieties of urticaria.

Urticaria annularis occurs in rings.
Urticaria figurata occurs in spirals.
Urticaria vesiculosa has vesicles on the summit of the wheal.
Urticaria bullosa is a bullous development on summit of wheal.
Urticaria papulosa is a wheal combined with a papule.
Urticaria tuberosa are giant wheals.
Urticaria hæmorrhagica is a combination of urticaria with purpura.
Urticaria pigmentosa is a pigmentation following the wheals.

The form most frequently met with in children is likely due to (*a*) ptomaine poisoning; (*b*) the result of some toxin in the system.

Causes.—Shell-fish, strawberries, and frequently cereals seem to be the cause of urticaria in some children. There is usually some gastric or gastro-intestinal disturbance at the time of the appearance of this rash. There seems to be a peculiar idiosyncrasy in some children to quinine and to other drugs which will bring out an attack of urticaria. A great many children have severe urticaria after an injection of antitoxin. (Read article on "Antitoxin Rashes.") Insect bites will sometimes cause this condition.

Symptoms.—There is severe itching, and scratching will frequently develop a new rash. Fever sometimes accompanies this condition. Urticaria once seen is very easily recognized and is not hard to differentiate.

The prognosis is usually good. We must remember that children prone to idiosyncrasies will have urticaria quite frequently, thus it will depend on the diet as to whether or no the rash remains away.

Treatment.—The first thing to do is to cleanse the gastro-intestinal tract. A saline or citrate of magnesia will always do good. Next in importance is the regulation of the diet. If a cause is found, remove the same.

Locally.—The severe itching can best be allayed by making a paste of bicarbonate of soda and cold water. Rub this paste into the hives. A cool tub bath, containing several ounces of bicarbonate of soda, will frequently relieve the itching. Menthol, 5 to 10 grains to 1 ounce of water, applied by means of a camel's-hair brush, is advised by some. Evaporating lotions, such as lead and opium wash or a weak solution of vinegar and water, or carbolated water, are recommended externally.

Large quantities of water should be given for thirst. It will also aid in eliminating toxins through the kidneys.

HERPES ZOSTER (SHINGLES).

"This is an acute inflammation consisting of a group of vesicles. It is mostly seen over a surface of skin corresponding to a definite nerve tract. It is accompanied by neuralgic pain."

Symptoms.—As a rule there is a broad band of vesicles corresponding to the affected area, usually following a nerve tract along the limbs or along the borders of the ribs. It develops very rapidly and frequently resembles an erythema. The crop of vesicles is frequently so thick that they almost touch one another.

Prognosis.—As this is a self-limited disease the prognosis is good, although neuralgic pains may persist for some time after the disappearance of the eruption.

Treatment.—Avoid irritant salves and use cooling dusting powders, such as bismuth, cornstarch, wheat flour, or powdered zinc oxide. The affected part should be covered with linen or gauze, not flannel or wool. To allay intense itching or inflammation use calamine and zinc lotion (see chapter on "Eczema").

CHLOASMA (TINEA VERSICOLOR: LIVER SPOTS).

This is a very mild form of eruption in which brown patches of skin are seen. It is caused by the invasion of a fungus.

Treatment.—The application of white precipitate ointment or 1 per cent. bichloride in alcohol has served me very well in removing the same.

PSORIASIS.

This is a chronic inflammatory disease affecting the extensor surfaces. It consists of a red scaly patch in which white silvery scales abound.

Etiology.—There is no specific factor, as it is found in both the rich and poor, although it frequently follows malnutrition of the body such as we see after the acute infectious diseases. This condition also frequently affects children of gouty parentage.

Symptoms.—The extensor surfaces are usually affected, hence the disease will be found on the extensor sides of the arms and legs. The symmetrical arrangement of this eruption on both sides of the body is a characteristic condition.

Prognosis.—This should always be cautiously given. As the disease has a chronic tendency it may remain for years unless actively treated.

Treatment.—Locally:—

℞ Resorcin	1 grain
Vaseline	1 ounce

Great care should be used in prescribing pure alcohol or tar. Such strong remedies should be avoided and a dermatologist should be consulted before advising heroic treatment. The following ointment has acted very well in these conditions:—

℞ Acidi carbolici	5 grains
Bism. subnitr.	1/2 drachm
Unguent. hydrarg. ammon	1-2 drachms
Ung. aquæ rosæ	ad 1 ounce

M. To be thoroughly rubbed into the affected patches, either alone or after washing with:—

℞ Acidi salicylici	1 scruple to 1 drachm
Spts. vini rectif	1 ounce
Glycerini	4 drachms
Aquæ rosæ	ad 4 ounces

(Bulkley)

Systemic Treatment.—No one must expect to cure this disease unless the emunctories are properly looked after. We must keep the bowels loose, the kidneys active, and give a vegetable, fruit, and cereal diet. The dairy products should be permitted, but meat must be excluded.

Restorative treatment such as codliver-oil, iron, and arsenic should be given liberally. In this disease arsenic proves itself of great value. Arsenic need not be feared and can be given to children in very large doses. Fowler's solution, in 3 to 10-drop doses three times a day, is usually sufficient.

IMPETIGO.

This infectious and contagious disease is characterized by an eruption which may appear on any part of the body. It is most frequently seen on the exposed parts, usually on the face and hands. It is most probably caused by the presence of the staphylococcus or streptococcus.

Symptoms.—There may or may not be fever at the onset of the eruption. The eruption usually commences on the face and hands. It is easily communicated from the sick to the well, as the following case will illustrate:—

F. R., 2 years old, was sent to me by Dr. W. H. The child had been in good health when one day the mother noticed a pustular eruption on the face, chiefly on the cheeks. Later it spread to the scalp and hands. It was associated with scabies and contracted by scratching. The infection spread to a second child and I was informed that some children playing with the patient contracted the disease. The treatment consisted in clipping the hair and saturating the parts with

℞ Ichthyol	1 drachm
Vaseline	1 ounce

This was applied three times a day with good result. Attention was directed to the condition of the stomach and bowels. Mist. rhei et sodæ, a teaspoonful was given three times a day.

The disease can easily be carried by clothing infected with the discharges from the crusts. In one case I recall, the child contracted impetigo by wearing the stockings of her older sister who was sick with the disease.

Treatment.—A general outline of the treatment has already been described in the clinical case given above.

A tub-bath consisting of kali sulphur (one ounce), dissolved in a porcelain or wooden tub full of water. The temperature of this bath should be about 100° F., and the duration of the bath about fifteen minutes. This bath should be repeated every night, before retiring, for one week. Follow the same with the ichthyol ointment well rubbed in, as above described.

PEDICULOSIS.

Among the poor or unclean we frequently see this condition. It is caused by the invasion of a parasite, the pediculus capitis. There is usually an eczematous condition and the adjacent glands are swollen. The habitat of the pediculus is in the hair, but it causes eczematous patches by irritation.

Treatment.—First remove the hair if it is at all possible; if not, saturate the hair with petroleum. This should be left on about five or six hours, after which the scalp and hair should be drenched with warm soapy water. The same treatment will be necessary every few days until a cure is effected.

Tincture of larkspur (tr. delphin.) is another valuable preparation when petroleum is objectionable. The hair and scalp should be thoroughly saturated with larkspur morning and evening and then thoroughly washed.

MILIARIA PAPULOSA (LICHEN TROPICUS: PRICKLY HEAT).

This variety of skin disease is frequently seen in summer. It consists of bright red papules on the summits of which there are very tiny vesicles, at times pustules may also be seen. The eruption is usually confined to those parts which are warmly clad, so that the abdomen, chest, and the extremities are most frequently covered. Eczema frequently follows this condition, and if severe scratching takes place, local infection ending in furunculosis may occur. The other parts of the body which do not have the eruption usually show extensive perspiration. This eruption comes and goes very quickly. It is frequently mistaken for scarlet fever. The absence of fever, the appearance of the tongue and throat, and the absence of the prodromal symptoms will easily differentiate this condition.

Treatment.—Rhubarb and soda or a dose of calomel at the beginning. If the kidneys are inactive, then 10 to 20 drops of sweet spirits of niter should be given, and repeated two or three times a day. For the intense itching the application of a paste consisting of bicarbonate of soda and water, will stop the itching. The body should be made comfortable by removing all warm clothing. A tepid alkaline bath, temperature 70° F.—a bath to which several ounces of bicarbonate of soda has been added—is very grateful and will give quick relief. After the bath dry the body thoroughly and dust cornstarch or wheat flour with talcum or zinc oxide, and let the child sleep with as little clothing on as possible. If improvement does not follow within twenty-four hours, then the application of the following salve will relieve itching and reduce the inflammation:—

℞ Zinc oxide	1 drachm
Calamine	1 drachm
Cold cream	1 ounce

M. Apply three times a day.

MILIARIA RUBRA (STROPHULUS INFANTUM: RED GUM).

This rash is the result of an irritation due to perspiration. It conconsists of red papules, sometimes having tiny vesicles. It is usually seen on the cheeks of an infant and always upon the side on which the infant sleeps.

The treatment is the same as that given in the chapter on "Miliaria Papulosa."

SUDAMINA.

Sudamina are small pearly bodies occurring during fever or exhausting diseases. They are usually seen over the sweat ducts. They are easily absorbed and fresh crops take the place of these tiny vesicles.

LENTIGO (FRECKLES).

This is a very common affection of the skin. It is usually seen in children over 5 years of age, and most especially in those having blonde or red hair. The skin is certainly more sensitive to sunlight in such cases, and successive crops of freckles frequently appear after exposure to the light.

The treatment consists in protecting the skin against exposure to the light. The freckles can be removed by a mild form of counter-irritation such as the application of a 1 per cent. solution of bichloride of mercury. Apply on cotton to the affected area for three or four successive hours. This form of counter-irritation destroys the skin, causing it to desquamate. The new epidermis which appears is free from this pigment.

SEBORRHŒA.

This is a very common condition of thick, dry, crusty formation which occurs on the head of infants. It most frequently involves that region surrounding the anterior fontanel. There are two varieties: (*a*) seborrhœa oleosa; (*b*) seborrhœa sicca. Some authors state that if the vernix caseosa in the new-born is allowed to continue it passes into a seborrhœa and may eventually become an eczema. When carefully examined, seborrhœa will be found to consist of epithelial cells, fat, and chiefly dirt. There are no inflammatory symptoms. When the scales are removed the skin is usually found normal.

Treatment.—The following is recommended:—

℞ Salicylic acid	15 grains
Vaseline	1 ounce

M. Rub the scalp thoroughly several times a day and leave on over night. Wash scalp with soap and warm water the following morning. If necessary repeat several evenings and wash in the morning as above directed. Sulphur soap is useful in this condition. The officinal ointment of sulphur can be rubbed into the scalp if this condition recurs.

FURUNCLE (BOIL).

This inflammatory condition occurs around a hair follicle or a gland of the skin. It is most likely caused by scratching, during which process there is an infection of the follicle with pyogenic bacteria such as staphylococcus pyogenes aureus. Frequently we see boils scattered through the scalp in large crops. At other times they occur singly. A boil begins as a small red spot in the true skin, very tender, and growing larger and larger. On palpation the center is soft and there is a tendency to suppuration. After suppuration has taken place and the boil emptied the swelling subsides.

Differential Diagnosis.—A furuncle has but one point of suppuration, whereas the carbuncle has many. A furuncle is usually a small swelling. A carbuncle very large, frequently several inches in diameter.

Diagnosis.—The diagnosis is usually very simple. This condition is usually met with in rickets. It especially affects those children having a tendency to head sweating.

The prognosis is usually very good.

Treatment.—Aseptic surgical details are demanded in each and every instance. The scalp should be shaved. The area of the skin involving the furuncle should be washed with carbolated soap and water, and subsequently with water. A free incision should be made, the pus liberated, and the part dressed with sterile gauze.

Iron, codliver-oil, and other restoratives are indicated. The value of nutritious food must not be overlooked.

CHRONIC PEMPHIGUS.[1]

This frequently follows the acute condition. It resembles the acute disease in producing a succession of crops of bullæ.

The prognosis depends on the condition of the child at the time when it was first attacked. If the infant is underfed and its vitality lowered thereby, then active restorative treatment should be instituted or the case will be lost.

Treatment.—The blebs should not be ruptured. They should be allowed to dry. The surface of the skin in the immediate neighborhood should be protected by a bland non-irritating ointment such as zinc salve or diachylon salve.

Sprinkling powder of zinc oxide, borated talcum, or cornstarch should be used. If the bullæ rupture, the serum should be absorbed with a little cotton and the neighboring parts protected from the excoriating effect of the contents of the ruptured bullæ. Careful attention must be given to the stomach and bowels. If necessary, a mild laxative should be given. The diet should be regulated both as to quantity and quality.

NÆVUS.

There are two kinds of nævus usually seen: (*a*) pigmentary, (*b*) vascular. *Pigmentary* occurs as small, rounded stains, which are either yellowish or dark brown. The cutis is raised, thickened, and frequently surrounded with a tuft of hair. They are most commonly seen on the face, neck, and hands.

Vascular nævus may be level with the skin or appear as tumors which project beyond it. The former is due to an excessive development of the capillaries of the skin. Commonly met with it is of a purplish hue, although it may be brick red, claret red, or a livid blue color. They are most commonly seen on the face and neck.

Treatment.—Blistering or caustics are recommended for the cure of this condition. I have frequently seen marked benefit from linear scarification by the Paquelin cautery. A radical operation should be considered if this milder form of treatment is unsuccessful.

TINEA TONSURANS (RINGWORM).

This disease is caused by the trichophyton tonsurans. When located on the scalp it is called herpes tonsurans; when on other parts of the body it is known as herpes circinatus.

Microscopical Appearance.—Squire says: "Under the microscope the stump of the hair appears ragged on either of its ends. Instead of breaking with a clean fracture, like healthy hair, the broken ends are digitated. The structure of the hair is greatly altered; its fibers are separated longitudinally, and the intervals filled with the spores of the trichophyton. On the surface of the hair are clusters of the same spores. The magnified piece of hair looks something like a bundle of faggots, with a number of berries sticking in clusters to its sides and ends, and stuffed here and there into its interstices. The spores of the trichophyton are rounded, have a well-defined outline, and measure about $^1/_{5000}$ inch across. In the earlier stages of the disease, when the hair has not yet become so brittle as to make it impossible to extract the root, it can be ascertained that the knob of the hair, as well as its root-sheath, is invaded by the spores of the trichophyton."

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[1] See article on "Pemphigus Neonatorum."

The disease commences with more or less itching and redness of some parts of the scalp; sometimes there is swelling. The hair growing on these patches loses its polish, and becomes dull. It is also brittle and easily breaks off near the root. This breaking off of the affected hairs gives the patch the appearance of having been lately shaved. There is a furfuraceous desquamation plainly seen on the scalp. The hair follicles become erect and the patch assumes a goose skin appearance. The margin of the patch is abruptly defined. There are usually several patches seen on different portions of the scalp. If we attempt to pull out the hair stumps by means of a tweezer we will note that only a portion of it comes away, leaving the hair root in the skin.

Treatment.—This consists in first cutting the hair as short as possible. Near the patch and around it a strong antiseptic soap such as a bichloride soap should be used. Absolute isolation should be enforced and children affected with the disease should wear oil-silk caps.

In an epidemic of ringworm in the New York Infant Asylum, the following combination of bichloride and kerosene proved extremely satisfactory: 10 grains of the bichloride were dissolved in alcohol, and to this were added 2 $^1/_2$ ounces each of olive-oil and kerosene. This was applied every day, being thoroughly rubbed into the diseased patches, and the whole scalp saturated with it. Considerable irritation usually resulted, and every few days the parasiticide was omitted and some simple emollient applied until the irritation had in a measure subsided. In some of the cases, the tincture of iodine was alternated with the bichloride and kerosene. Twenty-six cases were treated after this plan and all cured, the average duration of the treatment being eight and a half weeks.[1]

My own experience has been very successful with this method. Some authors advise an ointment composed of precipitated sulphur or citrine ointment. Another remedy advocated in this condition is washing the head daily with a strong antiseptic soap and then applying nitric oxide of mercury ointment.

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[1] See C. G. Kerley's report in New York Medical Journal, October 10, 1891.

The following method is also of value:—

Remove the superficial scales with the tincture of green soap, or by the use, for a day or two, of the pure green soap spread upon a piece of lint. Corrosive sublimate in 1 per cent. solution may be applied once a day, or the tincture of iodine, or carbolic acid in glycerine, 1 to 16, or the white precipitate ointment may be employed. I prefer the chrysarobin collodion painted over the patch every day or every other day. Kaposi's naphthol ointment is recommended by Lassar. Tar or sulphur ointments or Lassar's paste may be employed in obstinate cases.

Morris's thymol-chloroform oil is also beneficial.

MORRIS'S THYMOL-CHLOROFORM OIL.

℞ Thymol	1 part
Chloroform	4 parts
Ol. olivæ	12 parts

Or:—

SUBLIMATE SPIRIT.

℞ Hydrarg. chlor. corr.	1 part
Spts. vini rect.	500 parts

Or:—

TANNIN-SULPHUR PASTE.

℞ Acid. tannic	5 parts
Lac. sulph.	10 parts
Petrolati	50 parts
Zinci oxidi	17.5 parts
Amyli	17.5 parts

Or:—

CHRYSAROBIN COLLODION.

℞ Chrysarobini	1 part
Collodion flexible	10 parts

Verruca (Warts).

These small tumors of the skin are frequently met with in children. They may resemble a bunch of carrots (verruca digitata) or they may resemble a cauliflower. In size they vary from one-sixteenth to one-eighth of an inch in height. They frequently are seen on the face, neck, and hands. They produce no discomfort and are not serious.

Treatment.—Freeze the parts with ethyl chloride or ether. Pick the wart with a sharp curette. Another painless method consists in cauterizing first with pure carbolic acid, on top of which fuming nitric acid is applied. In using the latter caustic method the surrounding parts should be protected with vaseline.

BURNS (COMBUSTIO).

We frequently see burns of various degrees in children.

Causes.—They are usually caused by hot water, steam, acids, or alkalies.

Symptoms.—An intensely inflamed area surrounding a blistered surface is usually found. Pain and sometimes shock is noted. In some cases fever and a rapid increase in the pulse are noted. Violent reaction such as convulsions frequently occur in weak and rachitic children if a severe burn has taken place.

Prognosis.—This depends upon the amount of surface involved and on the condition of the child at the time of the accident. Some children survive extensive burns with good care. As a rule a cautious prognosis should be given, owing to the risk of infection and danger of shock.

Treatment.—Strict asepsis should govern the opening of all blisters. Cornstarch, wheat flour, europhen, or dermatol may be used locally. In addition thereto linseed-oil and lime water or calamine and zinc lotion (see chapter on "Eczema") is very valuable. Nutrition forms the most important part of the restorative treatment.

GANGRENE (SUPERFICIAL GANGRENE).

This condition affecting the skin or extending to the deeper structures is characterized by a bluish black discoloration resembling a deep form of cyanosis.

Causes.—It is a destructive condition following the acute infectious diseases, especially scarlet fever or measles. Traumatism or pressure interfering with the circulation of the blood or robbing the extremity of its nutrition may result in a destructive gangrene. The following case of traumatic gangrene occurred in my practice; it was a traumatic gangrene due to interference with the circulation:—

Baby A., ten months old, breast- and bottle-fed, was referred to me by Dr. A. Meyer. I found a temperature of 105° F., pulse 180, respiration 60. There was complete consolidation of one lobe of the left side. Bronchial breathing was plainly heard and there was dullness on percussion.

The diagnosis of lobar pneumonia was made. With the aid of cold packs and small doses of strychnine, the child's condition improved. As I left the city the case was treated by Dr. Khodoff, who gave me the following memoranda:—

"The nurse administered a high rectal enema by suspending the child with a towel around the thighs. The circulation was thereby interfered with. I believe the thrombosis which appeared at about the saphenous opening was of traumatic origin due to this interference of the circulation. The course of the gangrene was as follows: A bluish purple spot about the size of a ten-cent piece appeared at the saphenous opening. The child previous to this showed indications of pain. It was fretful, tossing about, and very restless. The gangrenous area increased on the following day. It was decided to wait for a line of demarcation as the child appeared to be in a state of collapse. On the third day after the first sign of gangrene appeared a rapid spreading took place upward along Poupart's ligament and continued above and involved the umbilicus."

When I again saw this case the gangrene involved the whole abdomen. The temperature was 102° F., the pulse very feeble, and the child in a state of collapse.

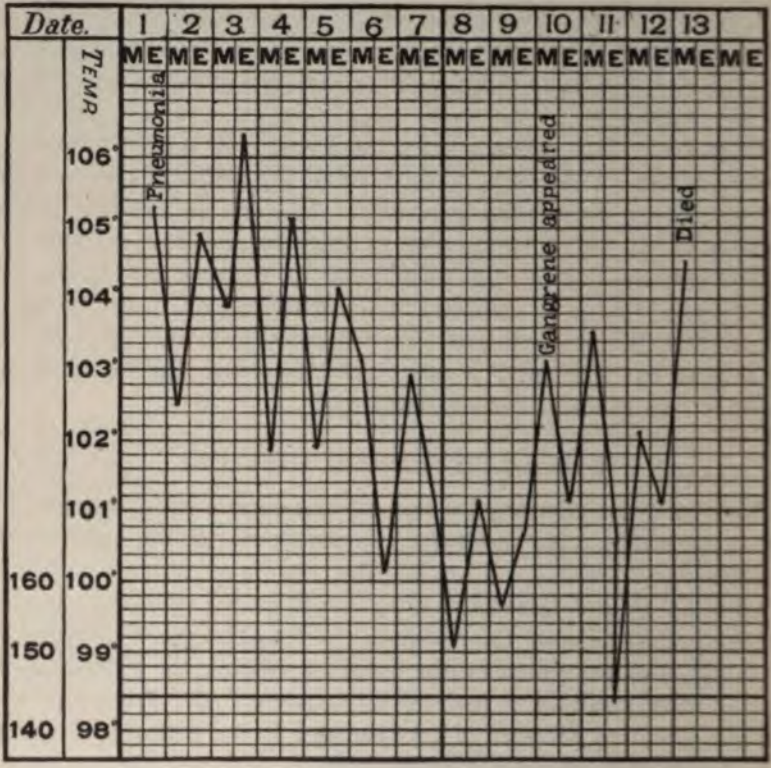

Fig. 289.—Case of Gangrene Following Lobar Pneumonia. Gangrene appeared on the tenth day of disease, due to a careless method of suspending the child by a towel around the thighs, which resulted in thrombosis, ending fatally. (Original.)

It was necessary to stimulate and feed per rectum. The child did not respond to treatment and died in convulsions.

Prognosis.—The prognosis is always bad, although surgery may be the means of amputating a gangrenous extremity and saving the rest of the body.

Treatment.—There is no medicinal treatment worth trying. Surgical relief is our only hope.

SYMMETRICAL GANGRENE (RAYNAUD'S DISEASE).

This is an obscure condition in which the gangrene is symmetrical.

Etiology.—It is caused, no doubt, by the invasion of pathogenic bacteria. Infectious diseases which devitalize the body are believed to predispose to this condition. Injury and hæmorrhages, such as epistaxis, have been forerunners of this condition.

Symptoms.—When acute there is fever and enlargement of the spleen, hæmaturia, or hæmoglobinuria. The affected part feels cold and appears bluish; sometimes there are vesicles containing a sero-purulent fluid. This condition lasts from two to three weeks, although it may extend over many months. The disease ends in mummification and gradual decay of the affected parts. The toes, fingers, ears, or tip of the nose may be the seat of this affection.

Prognosis. — A cautious prognosis should always be given. While records of cures exist, the diagnosis may always be questioned.

Treatment.—General restorative treatment, concentrated foods, and hygiene should form the basis of treatment. The skill of the surgeon may eradicate the gangrenous parts.

CHAPTER IV.

ABNORMAL GROWTHS OCCASIONALLY MET WITH IN CHILDREN.[1]

ABNORMAL growths are frequently seen in children. Some of these are malignant, while some are benign. We must not suppose that children do not have malignant disease. I have seen malignant sarcoma involving the whole of the left lung which crowded the heart into the right axillary space.

SPINDLE-CELL SARCOMA OF THE THORAX.[2]

Gustav L., a male child of about 8 years, was first seen by me in July, 1900. His mother gave the following history:—

He was breast-fed about ten weeks and owing to a diminution in the quantity and quality of her milk, she was forced to wean the child. He then received sterilized milk. This food was given until the child was weaned from the bottle at about the end of his second year.

When about six months of age, a large, glandular swelling commenced behind the right ear, which necessitated an incision. The attending physician said it was an abscess. At this same time, he had a severe attack of gastric fever. This required careful dietetic treatment. Cow's milk was continued in a more modified form.

At age of 1 year the child was attacked with measles, accompanied by a catarrhal bronchitis. Some cough remained and when the child was 2 years old he had a severe attack of pertussis. When the child recovered, he remained well until he was $3\,^1/_2$ years old, then he was infected with scarlet fever lasting two months. Thus the child passed his infancy with some gastric derangement, followed by measles, pertussis, and scarlet fever. He did not have croup or diphtheria.

"*Family History.*—This is good. The parents of this patient are both living, and apparently strong and healthy; they have two other boys, well and strong. There is no history of syphilis, rheumatism, gout, tuberculosis, epilepsy, nor anything of a malignant nature in the family, excepting this fact which is extremely noteworthy, that the grandfather had a sarcomatous tumor, which ended fatally.

"*Examination.*—The patient was brought to me for the relief of a number of tumors on the front of the thorax, which felt quite hard on palpation. At times a distinct sense of fluctuation could be made out, and when examined by an exploratory puncture, a few drops of thin, yellowish serum was obtained. These tumors have been very troublesome for the past few years. They have caused severe dyspnœa. The physician who treated this boy in Hamburg believed that the growths contained pus. This statement was made to the family. The physician made an exploratory puncture and was rewarded by a few drops of thin, serous liquid, as in a puncture I made and obtained no pus.

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[1] For complete list surgical works should be consulted.

[2] Read before the Section on Pediatrics, the New York Academy of Medicine, April 10, 1902.

"The size of the growth as seen externally is about 15 centimeters in length and about 6 to 7 centimeters in circumference. (See Fig. 290.) There is marked dullness on percussion extending over most of the left side. The tumor is surrounded by a network of veins, intensely engorged with blood. There is mediastinal pressure. As far as can be seen and palpated, the growth occupies that region of the thorax *usually occupied by the heart.* The growth varies in size from week to week.

"The heart has been pushed to the right side and occupies the right axilla. The apex beat is heard about two finger breadths below and to the right of the *right nipple.* (See figure 291.)

"The pulse is 144, small, feeble, quite irregular and easily compressible. The respiration is irregular, of the Cheyne-Stokes type, and frequently sighing. It is usually about 50-52 in a minute; the temperature is always above normal and varies from 100° F. in the rectum, morning, to $101\,{}^{2}/_{5}^{\circ}$ in the evening. There is always a febrile tendency.

"There is constant dyspnœa and also extreme cyanosis of the lips, fingers and toes. The child is very pale and in a very anæmic condition. There is extreme pallor of the conjunctival membrane, the gums, and the mucous membrane of the lips."

Owing to the extreme amount of weakness caused by anorexia, the child was compelled to remain in bed most of the time for the last year. Dyspnœa was so great that the child slept in a sitting posture. The child was very nervous and trembled when he was touched. He was very bright mentally. There was constant and rapid emaciation. Concentrated food was given, which the patient took quite well. There was extreme hyperæsthesia of the skin. The digestion was quite good, and although the bowels moved sluggishly, they did not require much medicinal treatment. Fruit and fruit juices acted as laxatives. There was a curvature of the spine from left to right, most marked in the dorsal vertebra. The urine was examined several times. It showed no evidence of pus or blood, no albumin and no sugar. There was a slight indican reaction. No acetone, no casts, no morphotic elements, microscopically.

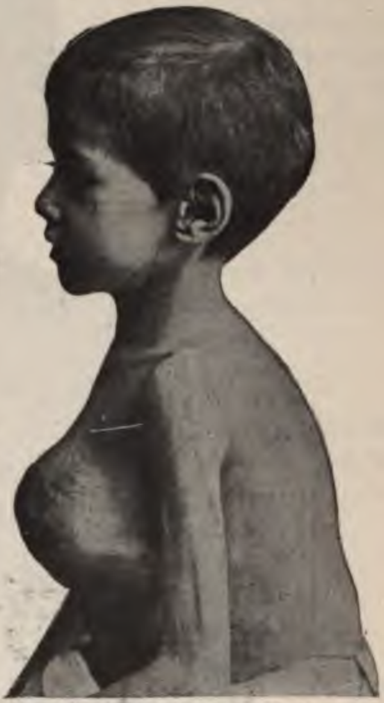

Fig. 290.—Spindle-cell Sarcoma. The prominence of the tumor shows by contrast the emaciation of the body. (Original.)

The case was hopeless from a medical standpoint, as the growth was constantly increasing. The child suffered constantly from insomnia and great dyspnœa, requiring constant soporifics and narcotics. In spite of the grave prognosis, the family hoped that surgical measures might afford some relief.

As the tumor frequently appears to show a distinct pointing, this latter condition suggesting fluid, an anæsthetic was given with the assistance of Dr. J. W. Wurthman. The anæsthetic was badly borne and I succeeded with difficulty in making two exploratory punctures.

An x-ray examination, to verify the clinical data, was made by Dr. C. Beck, to whom the case was referred. The heart could be plainly seen pulsating on the right side. No definite satisfactory data could be learned concerning the tumor, on account of the restlessness of the patient, and the child was removed to St. Mark's Hospital and operated. The child died soon after the operation.

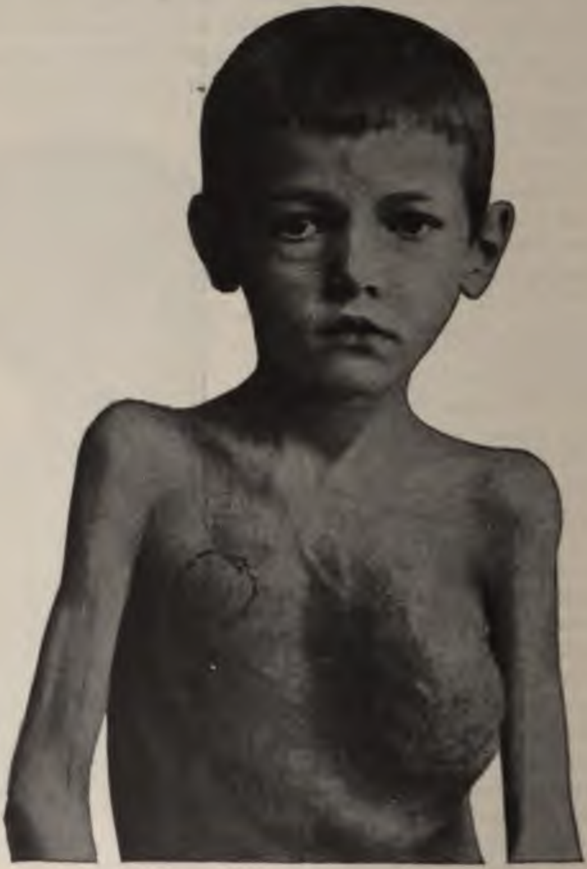

Fig. 291.—Anterior View of the Tumor. Showing also the position of the displaced heart and the enlarged veins. (Original.)

A specimen of the tumor, removed during the operation, was sent by me to Dr. Mandlebaum, for a pathologic examination. He reported the tumor to be a spindle-cell sarcoma in a rather active state of growth, on account of the large number of mitoses present. The fluid contained simply red blood cells and no pus.

Sarcomatous growths in children are quite rare, though met with from time to time. Thus Mauderli, in the Children's Hospital of Basle, Switzerland, reports for the last twenty years that he treated a total of 10 patients: 7 boys and 3 girls, of whom 4 were under 3 years of age, 3 were between 3 and 6 years, 1 was between 6 and 9 years, and 2 were between 9 and 12 years.

As but one case of malignant sarcoma was met with in this hospital in the course of the last twenty years in children as old as the case here reported by me, I feel justified in adding mine to those already recorded.

The interesting points about my case were: (1) The displaced heart—the heart being immediately behind the right nipple. The pulsations and apex-beat could be distinctly felt and seen about two finger-breadths below the right nipple. (2) The intense dyspnœa caused by pressure of the tumor. (3) Constant cyanosis and œdema of the limbs, due to interference with the return circulation to the right side of the heart.

CARCINOMA.

Carcinoma is occasionally found in children. Malignant growths of this kind have been diagnosed and verified by microscopical examinations.

LIPOMA.

Fatty growths are occasionally seen in children. They occur on the scalp, on the back, and I have seen them on the buttocks. They require the same treatment as fatty growths in adults. (See article in the "Newborn Baby" on "Congenital Sacral Tumor.")

ENCHONDROMATA.

These hard growths are usually found on the fingers and toes. They are found in the neighborhood of the joints with which they are closely allied. A case of this kind which had several tumors removed, occurred in my practice:—

Mary B., 10 years old.

Family History.—Father healthy. Mother died of carcinoma of the uterus. Has one sister who is healthy and married.

Patient's History.—Was breast-fed during infancy. Suffered with no gastric or enteric disorders. Had measles when several years old. Is not subject to any chronic disease. Her extremities are normal excepting the affected hand. The mother stated the tumors had been present soon after birth. They were not painful nor did they cause discomfort, so nothing was done until the child reached this age. The case was referred by me to the surgical service of Dr. S. M. Landsman, who removed the growths. The case made a perfect recovery.

SPINA BIFIDA.

Abnormal growths are frequently found in the lumbar region associated with the spinal cord. They are frequently seen in cases of hydrocephalus. A case of spina bifida is reported in the chapter on "Malformations of the Spine."

ANGEIOMA.

Angeioma.—Large vascular growths are occasionally seen in children. A case of this kind was seen by me, which I describe in the chapter on the "New-Born Baby," page 53.

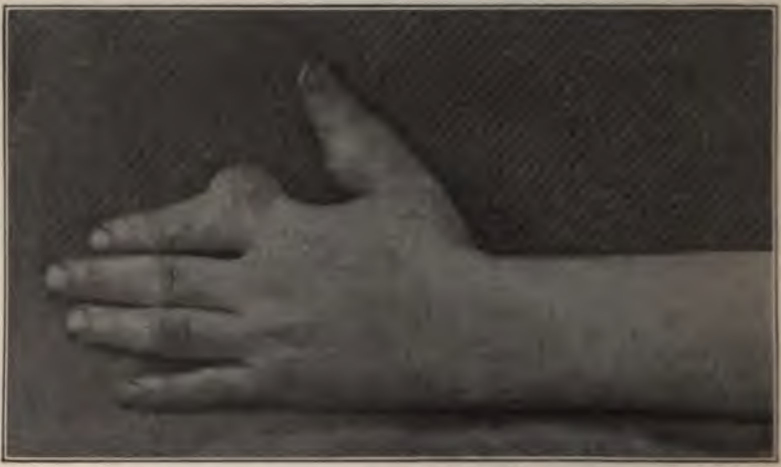

Fig. 292.—Enchondromata Involving the Thumb and Index Finger. (Original.)

PAPILLOMATA.

This growth is occasionally seen in the larynx of infants and children. It may be congenital.

Symptoms.—Marked dyspnœa is usually a prominent symptom. This dyspnœa increases with the enlargement of the growth. There is also a husky voice, which increases in severity. The symptoms are very marked at night, but are much less, and frequently disappear entirely, during the day. Cough may also be present, but no expectoration. There is no fever. The diagnosis is usually made by a laryngoscopic examination. When the same symptoms appear for weeks and months a laryngeal growth should be suspected.

Treatment.—Removal of the growth with an anæsthetic is absolutely necessary. The danger in removing the growth should always be borne in mind, hence the surgeon should be prepared to perform a tracheotomy if necessary. Intubation of the larynx will relieve the difficult breathing; at the same time there is danger of pushing some of this growth with the tube, thus obstructing the caliber of the same. Relapses are common.

GRANULOMATA.[1]

These growths are frequently seen at the site of the wound following a tracheotomy. They resemble a mass of exuberant granulations.

Prof. A. Rosenberg, of Berlin, collected 231 cases of laryngeal tumors in children. Some of them were subjected to tracheotomy, others received endo-laryngeal treatment preceded by tracheotomy. In another series of cases persistent endo-laryngeal treatment was resorted to without performing tracheotomy. This latter method yielded the better results.

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[1] In Part II., Page 33, will be found article on "Granuloma."

PART XI.

DISEASES OF THE SPINE AND JOINTS.

Pott's Disease.[1]

This disease derives its name from Percival Pott, who described it in 1779. "It is a chronic destructive process which begins in the bodies of the vertebræ. The bodies of the vertebræ support the weight of the body. As the disease progresses the weakened parts give way, and the upper segment inclines forward. An angular posterior projection, ***kyphosis,*** is formed which is the characteristic deformity of the disease."

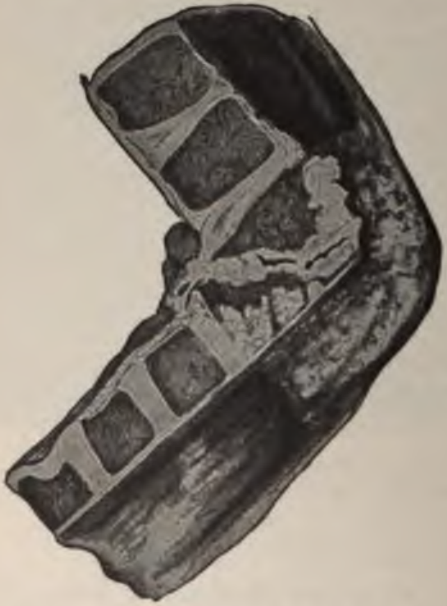

Fig. 293.—Pott's Disease (Langerhans). Kyphosis of dorsal vertebræ, the result of caseous tuberculous periostitis and osteomyelitis. Destruction of three thoracic vertebræ. Two-thirds natural size.

Etiology.—"Pott's disease may appear at any period of life, from earliest infancy to old age, but like all forms of tuberculosis of the bones, it is most common in the first ten years of life, and 50 per cent. of the cases begin between the ages of 3 and 5 years, inclusive.

"The lower segment of the spine, including the dorso-lumbar region, is most often involved. Cervical disease is relatively infrequent (cervical,

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[1] The table of differential points between Pott's Disease and Rickets will be found on page 356.

7 1/2 per cent.; dorsal, 68 per cent.; lumbar, 24 per cent.). The death rate is at least 25 per cent. The course of the disease is most protracted in the middle region; it is shortest in the cervical region, its duration varying in favorable cases from two to five years.

"When the local resistance overcomes the tendency to degeneration, the process of repair begins. The tuberculous products are absorbed or enclosed, and ankylosis between the two segments of the spine is established by means of a union, in part fibrous, cartilaginous, and bony. Firm union is long delayed, and the deformity may increase long after the disease has become inactive" (Whitman).

Pathology and Bacteriology.—"The first indications of disease are most often found beneath the fibro-periosteal layer of the anterior longitudinal ligament. From this point the granulation tissue advances along the course of the blood-vessels into the adjacent bone, extending from one to another until several bodies are more or less involved. The disease is accompanied, in many instances, by an abscess, which may be of sufficient size to cause special symptoms; or the tuberculous process may find its way to the posterior part of the vertebral bodies and thus involve the spinal cord, causing paralysis. Abscess is most common as a complication of disease of the lower part of the spine, where it may be detected in at least 50 per cent. of the cases. Paralysis most often complicates disease of the upper dorsal region, appearing in about 10 per cent. of the cases in which this part of the spine is involved. The primary infection is no doubt due to the entrance of the tubercle bacillus."

Anatomical Landmarks.—"The atlas is on a line with the hard palate. The axis is on a line with the free edge of the upper teeth. The transverse process of the atlas is just below and in front of the tip of the mastoid process. The hyoid bone is opposite the fourth cervical vertebra.

"The cricoid cartilage is on a line with the sixth cervical vertebra.

"The upper margin of the sternum is opposite the disc between the second and third dorsal vertebræ.

"The junction of the first and second sections of the sternum is opposite the fourth dorsal vertebra.

"The tip of the ensiform cartilage is opposite the lower part of the body of the tenth dorsal vertebra.

"The anterior extremity of the first rib is on a line with the fourth rib at the spine, the second with the sixth, the fifth with the ninth, the seventh with the eleventh.

"The scapula covers the second and the seventh ribs, its lower angle being opposite the center of the eighth dorsal vertebra.

"The root of the spine of the scapula, the glenoid cavity, and the interval between the second and third dorsal spines are in the same plane.

"The most constant landmark from which to count is the spinous process of the fourth lumbar vertebra, which is on a line with the highest point of the crest of the ilium. The umbilicus is near the same plane.

"The tip of the coccyx is opposite the lower border of the symphysis pubis."

Symptoms.—If the upper part of the spine is affected, a stiffness of the neck usually exists. If the lower part of the spine is affected, limping will be noticed, hence awkwardness in walking in very anæmic children should always be looked upon as suspicious.

"The limitation of motion due to muscular spasm, to pain, and to the local disease is an important factor in diagnosis. This, together with the deformity, may be demonstrated by bending the patient's body directly forward to the fullest extent. An object is next placed on the floor, and the patient is directed to pick it up. If this is done awkwardly by squatting or kneeling, it demonstrates weakness and stiffness. The patient should next be placed prone upon a table, and the surgeon should test the flexibility of the spine by lifting the legs and swaying the body from side to side. The range of extension at the hips may be tested at this time by holding the pelvis against the table with one hand, while the thigh is overextended with the other. This is the test for the slight degree of psoas contraction that is often present on one or both sides in disease of the lower region.

"The flexibility of the upper part of the spine may be tested by voluntary and passive movements of the head in various directions, and the range of motion of the occipito-atlo-axoid joints by holding the neck while the patient nods and turns the head from side to side.

"The character and the extent of the deformity, if it be present, should next be investigated. Note the contour of the spine. Any change from the normal are, in childhood, suspicious circumstances. Note the elasticity of the spine. If when the child is bent forward the spine forms a long, regular, even curve, disease is unlikely. If there be a break in the outline, and if one part remains rigid and another bends, disease may be suspected."

Pott's disease in the lower region of the spine presents the following characteristics:—

1. *Pain.*—The pain is referred to the lower part of the abdomen, to the genitals, to the loins, or to the thighs.

2. *Gait.*—The waddling gait which has been described under general symptomatology is characteristic of disease in this region. In some cases there is a limp.

3. *Attitude.*—Usually an abnormal erectness and sometimes an exaggerated lordosis; in some instances a lateral inclination of the body. Unilateral psoas contraction and the attendant limp are often present.

4. *Stiffness.*—Muscular rigidity of the lumbar region interferes directly with almost every attitude and movement. The effect of this

stiffness and of the accompanying weakness may be demonstrated by the popular method of asking the child to pick up a coin from the floor. In this region of the spine the symptoms are usually well marked before the stage of deformity, flexion of the legs, the effect of psoas contraction, and abscess are present in perhaps a third of the cases.

Pott's disease of the middle region is characterized by the following peculiarities:—

1. *Pain* is referred to the lateral region of the thorax or to the front of the body. It is a common symptom. It is noted after sudden movements or after compressing the chest, as when the child is suddenly lifted from the floor.

2. *Respiration.*—If the disease is at all active, a grunting respiration is usually present, especially after exertion. This is the most characteristic of all symptoms, especially so in young subjects.

3. *Attitude.*—This is not always distinctive, but usually there is a peculiar shrugging squareness of the shoulders; occasionally a lateral inclination of the body. The head is often inclined backward. The neck seems short on account of the elevation of shoulders.

4. *Deformity.*—The deformity is usually prominent and it appears early in the disease.

5. *Complications.*—The most common complication of dorsal disease is paralysis, abscess being less frequent than in the lumbar region. Flat chest and chicken breast may be secondary deformities.

Pott's disease of the upper region presents the following peculiarities:—

1. If the uppermost cervical vertebræ are diseased, the *pain* is referred to the head, particularly to its lateral and posterior aspects. In disease of the middle cervical region it is referred to the neck, or to the shoulders or chest.

2. The *weakness and stiffness* are manifest by the *attitude.* The head cannot be turned freely. If the disease be in the occipito-axoid region, the nodding and rotary motions are restricted. The chin is often depressed and slightly turned to one side. Lateral distortion resembling torticollis usually occurs when disease is nearer the middle of the cervical region.

3. The bony *deformity* is often slight or absent, but thickening of the tissues about the spine and local sensitiveness to lateral pressure are usually present. Retro-pharyngeal abscess is not uncommon when the atlo-axoid region is involved.

Complications.—(a) *Abscess;* (b) *Paralysis:* About 25 per cent. of all cases have abscess. An abscess situated in the atlo-axoid region often burrows into the retro-pharyngeal space. It may involve the cranial cavity when this occurs; symptoms of meningitis will be noticed. When an abscess forms from disease of the middle cranial region it usually opens on the side of the neck, before or behind the sterno-cleido mastoid region. When abscess follows disease in the dorsal region it burrows through the thorax. It can be detected by the physical signs accompanying pain (see chapter on "Empyema").

When it burrows downward it may give rise to an iliac or lumbar abscess. "In disease of the lumbar region, the abscess, if superficial to the ilio-psoas muscle, may point in the neighborhood of the anterior superior spine, or pass through the inguinal ring. The true psoas abscess first distends the iliac region, and then passing into the thigh, appears in Scarpa's space. In large abscesses of this character the pus may find an exit in the loin at the triangle of Petit, or in the gluteal region through the sacro-sciatic foramen.

"In rare instances the abscess may find an opening within the body, and burst into the lungs, the intestines, or elsewhere.

"As a rule abscess causes but little difficulty in diagnosis, because it is a late symptom, appearing after the diagnosis of Pott's disease has been established. It is more often an early symptom in the upper and lower regions of the spine, but in any event it is always accompanied by symptoms of the underlying disease of the spine."

Paralysis.—The symptoms of Pott's paralysis are "an awkward stumbling gait, weakness, and finally an inability to stand. The lower limbs are 'stiff' at times. The reflexes are increased. Control of the bladder may be retained, but often there is active incontinence; that is, the bladder empties itself from time to time. If the pressure is directly upon the reflex centers in the lumbar enlargement, there may be passive incontinence or dribbling of urine. If the pressure is below the reflex centers, the bladder is not affected, and the symptoms of numbness and weakness resemble those caused by neuritis."

Differential points concerning abscess:—

1. Abscess of the cervical region must not be confounded with the symptoms of enlarged tonsils, adenoids, or with so-called croup. It must also be distinguished from the simple acute abscesses of this region.

2. Abscess of the thoracic region is to be distinguished from those secondary to disease of the lung or of the chest wall.

3. Abscess in the loin or inguinal region may be mistaken for the acute or chronic abscess due to:—

(a) Perinephritis.	These are usually of acute onset and are accompanied by constitutional disturbances.
(b) Perityphlitis.	There may be secondary rigidity of the spine, but no deformity, as is usual in Pott's disease at the stage of abscess formation.
(c) Sacral or iliac disease.	The symptoms of Pott's disease are lacking.
(d) Hernia.	

The *paralysis* of Pott's disease must be distinguished from

1. Simple weakness.
2. Injury to the cord.
3. Tumors of the cord.
4. Syphilitic disease of the cord.

The *weakness and stiffness* caused by Pott's disease in the lower region may be simulated by lumbago, rheumatism, sciatica, and by the effect of injury or strain. Lumbago, rheumatism, and sciatica are uncommon in childhood. They are usually of sudden onset. Sciatica is usually unilateral; the pain of Pott's disease is usually bilateral. Strains and other injuries have, as a rule, a well-defined history.

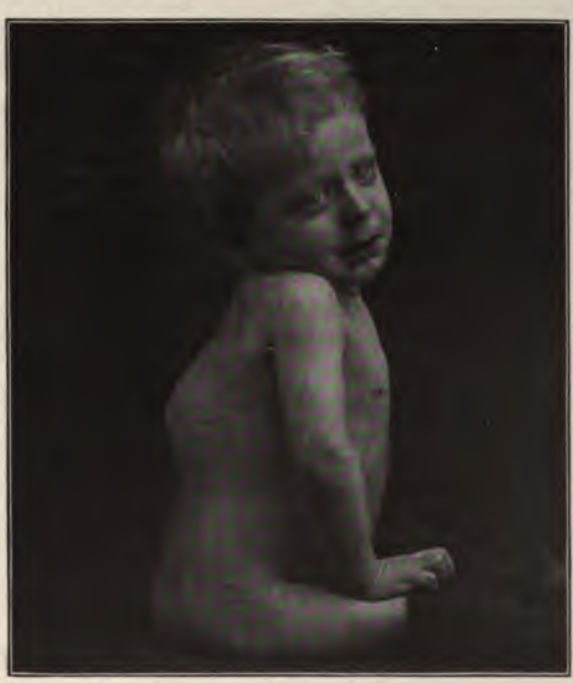

Fig. 294.—Pott's Disease. Case of Harry F. (Original.)

Prognosis.—This should be cautiously given. While most cases seen by me ended fatally, several cases improved and recovered entirely. Years of patient treatment are necessary, and occasionally the most severe cases may end in recovery.

Harry F., 4 years old.

Family History.—Father and mother are unhealthy, weak and very poor. One child has died of summer complaint. Another, two years younger, is inclined to cough, and was operated by me for empyema.

Personal History.—The child was born and has since then lived in a tenement house, in a densely populated section of the city. He was a bottle-fed infant, and has been constipated since birth, although he suffers with diarrhœa in summer. Has always been a frail and sensitive child. Has had measles and bronchitis, and is constantly troubled with some catarrhal affection. The child was late in walking, late in talking, and late in dentition. The general development shows backwardness when compared with a normal child. A slight deformity of the spine was first noticed when the child was about 2 years old. It has increased in prominence since that time. There is no distinct evidence of tuberculosis that can be made out in the lungs. The glands are not enlarged, there is no cough or expectoration. No evidence of fever.

The treatment consisted in giving codliver-oil and creosotal internally from 2 to 5 drops, three times a day. Friction of the body and general hygienic measures were instituted. Great stress was laid on the nourishment of the body. Cream, butter, eggs, cereals, and vegetables have been given constantly.

Orthopædic Treatment.—For the relief of the deformity, a supporting brace fitted to the body like a corset, similar to a Bradford frame, had been used for over six months with little improvement, therefore the case was sent to Dr. Ashley for a plaster-of-Paris corset. This treatment has been very successful, and the child is progressing favorably.

Treatment. — When pus is present nothing but surgical treatment should be considered. Surgical treatment is not always necessary. The majority of cases require support by means of (*a*) spinal splint; (*b*) spinal brace; (*c*) plaster jacket.

Either of these must be properly applied by a competent surgeon. I have seen some very disagreeable accidents due to a too tight plaster corset. For details in connection with the application of braces or plaster jackets the reader is referred to text-books on orthopædic surgery.

Medicinal Treatment.—This consists in giving restoratives such as codliver-oil, iron, and arsenic. Creosotal can be given with the codliver-oil. A rigid diet such as cream, butter, milk, cereals, eggs, vegetables, and fruits is indicated.

If the child lives in the city a change to the seashore or to the mountains will sometimes improve the chances of recovery.

Flatfoot in Children.

Children are not born flatfooted. Very heavy children are predisposed to flatfoot, especially if rickets is present. Laxity of the knees is usually found associated with this condition.

Treatment.—Careful orthopædic treatment is necessary. This usually consists in wearing a properly fitting shoe in which the arch is supported with the aid of a stiff steel or celluloid plate. At times a soft pad of felt only is necessary.

R. W. Lovett, of Boston, has contributed to the literature of this subject, and the reader is referred to his writings for details on this matter.

LATERAL CURVATURE OF THE SPINE.

A very frequent condition seen in weak children is curvature of the spine.

Etiology.—Children that were bottle-fed in infancy and especially those having rickets usually develop this condition. Anæmic children and those with flabby and atonic muscles are susceptible. *It is especially due to faulty habits of posture in the schoolroom.*

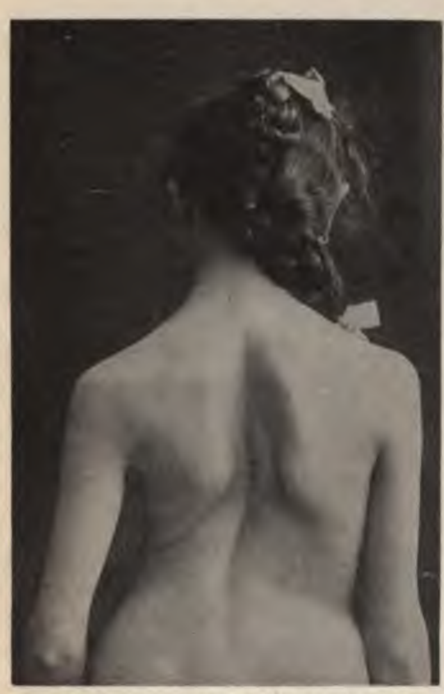

Fig. 295.—Schoolgirl, Showing Lateral Curvature of the Spine, Due to Faulty Position. (Original.)

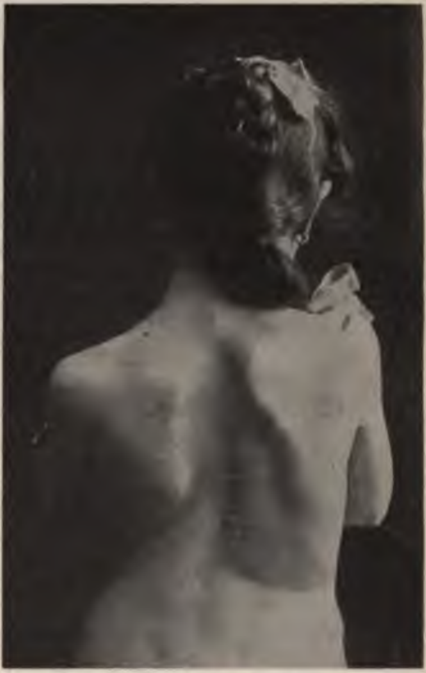

Fig. 296.—Lateral Curvature of Spine. Same girl. Arms folded. (Original.)

Symptoms.—Unless the child is undressed, no special symptoms may be noticed. At times a difference in the height of the shoulders and in the hips will be apparent. Pain is usually absent, although I have heard children, especially older girls, complain of backache constantly.

Prognosis.—This is usually good.

Treatment.—Gymnastics and exercises such as dumbbells and pulley weights under the guidance of a competent instructor will usually develop the special muscles and correct this deformity. The sedentary life of a boy or girl so affected should be changed to an outdoor active life. The diet should be largely composed of proteids, such as meat, milk, eggs, and cereals. Cold sponging or a shower bath followed by friction of the surface should be prescribed daily. Internally strychnine or nux vomica. If the patient is not well-nourished, butter, cream, codliver-oil, and malt extract should be ordered.

Mechanical Appliances.—The use of a spinal brace is frequently advised. It is neither scientific nor beneficial, and certainly does not remedy this condition.

MORBUS COXARIUS (HIP-JOINT DISEASE: TUBERCULAR HIP-JOINT DISEASE).

Coxitis, commonly known as tuberculosis of the hip-joint, is not easily diagnosticated in the primary stage.

The age is no hindrance to the development of this disease, as it usually appears between the fifth and tenth year.

Coxitis can be found in apparently healthy children, showing no sign of scrofulosis.

1. They complain of tenderness.
2. Impediment of locomotion of the affected extremity.
3. The change of the position.
4. Local changes in the region of the joint.

Symptoms.—The pain is one of the earliest symptoms and expresses itself by a feeling of tenderness in the affected joint or in the knee. The knee is quite characteristic in this affection and serves a good center for deception. In the knee no changes are directly noticeable; there is no impediment to locomotion. When the pain can be located in the knee-joint the pathological process in the hip-joint is usually fully developed. When children complain of pain in the knee-joint it is always wise to examine the hip. One of the most characteristic symptoms is the invariable cry at night.

The child will cry frequently and will suddenly awaken at night, with pain along the thigh not pointing to a distinct spot, but showing that the pain is diffused along the leg; this symptom is rarely absent in true coxitis.

At the earliest stage of coxitis the pain is trivial, but instinctively the patient tries to use the healthy limb and not the unhealthy one. This is one of the causes of limping. When tenderness can actually be located, then locomotion is also limited. When this exists, difficulty in abduction and adduction appears.

When examining by grasping the affected limb with one hand and supporting the small of the back with the second hand, a distinct resistance of the muscles can be felt.

TUBERCULOUS COXITIS (DOUBLE).

C. M., 10 years old, girl. Duration of disease, in left hip six years, and right hip five years. No history of exanthematous diseases. Treated at the Post-graduate for seven months in orthopædic ward. An erasion of disease in left hip at this time.

Examination.—Right hip flexed to 90°, left hip flexed to about 95°. Right hip in adduction 10°, distinct spasm of the adductor muscles. Left hip in adduction 35°, slight spasm of the adductor muscles. Motion in right hip 10°, in left hip 20°. Right great trochanter two inches above Nelaton's line. Apparently no abscesses. Left trochanter almost denuded by erasion, only slightly above Nelaton's line. Many abscess scars, all healed.

Treatment.—Modified Gant on right side, forcible correction of the left side, with tenotomies.

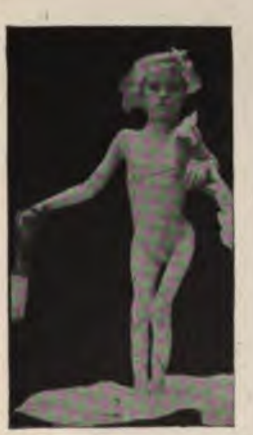

Fig. 297.—Tuberculous Coxitis—Front View.

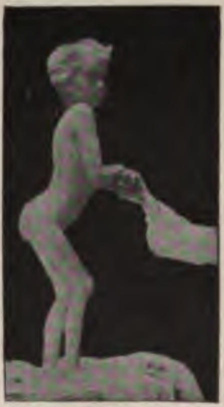

Fig. 298.—Tuberculous Coxitis—Side View.

CONGENITAL DISLOCATION OF THE HIP.

This is the most frequent form and the most important of the congenital dislocations.

Etiology.—Faulty development of the acetabulum and the head of the femur combined with laxity of the capsule and possibly pressure upon the flexed thigh are supposed to be the causes of this condition. The displacement is usually upon the dorsum, although it may take place forward or upward. It is most frequent in females. Whitman states that 85 per cent. occur in females. It is usually seen unilateral. I have seen many

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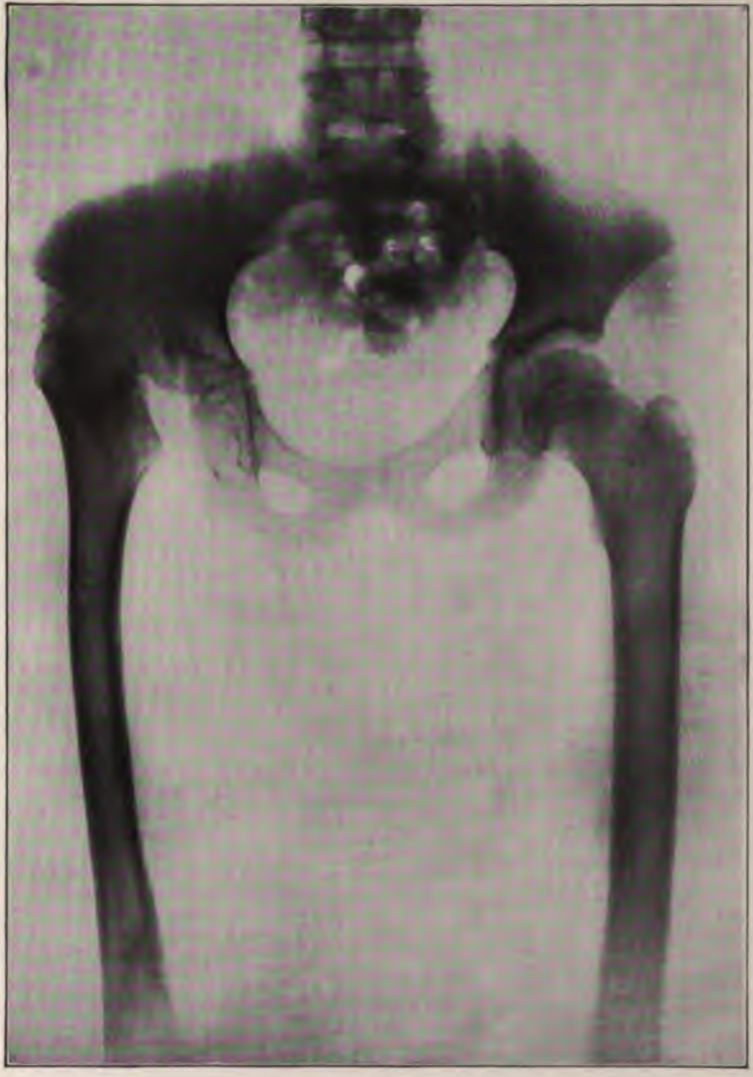
Illustrations Figs. 297 and 298 are furnished through the courtesy of Dr. Dexter Ashley.

PLATE XXVII



X-ray of Congenital Dislocation of Hip.

G. L., male, 9 years old; A. L., female, 6 years old; H. L., female, 4 years old. Three out of five children in one family, of Irish parentage. No previous history of lameness.

G. L., double posterior dislocation; muscular; great telescopic motion; right side has a shortening of 2 $^{1}/_{4}$ inches, left side 2 $^{3}/_{4}$ inches, as per Nelaton's line; head and neck apparently well developed; thighs flexed adducted and rotated inward; marked lordosis; walking ungainly and laborious; limited motion in abduction and extension; feet inclined to be flat; can stand in almost normal position except lordosis. Skiagraph reveals very well-developed neck on each side, the right inclined to coxa varus; head on each side inclined to be conical; acetabula rather shallow, but well formed otherwise. Advised no operation as the child was too old, and the circumstances of the family would not admit of good after-treatment.

A. L., right posterior dislocation; distinct limp; limb carried slightly in adduction; shortening 1 $^{1}/_{2}$ inches; neck short and straight, or coxa valgus. Skiagraph verifies above observations, and shows an apparently poorly formed acetabulum, with considerable thickening. Preternatural mobility in all directions except abduction. Operation advised and performed. Transposition secured.

H. L., 4 years old; posterior dislocation; $^{3}/_{4}$ inch shortening; limp well marked; neck and head rather short but of normal angle; preternatural mobility in all directions except abduction. Skiagraph reveals short head and neck, apparently well formed acetabulum. Operation performed. Very good result, but might have been improved upon if child had been brought in for after-treatment.

KNEE-JOINT DISEASE.

This is a chronic tuberculous inflammation due to an osteitis of the femur or tibia. It may begin as a synovitis similar to hip-joint disease.

Etiology.—Traumatism is usually the exciting factor, as in hip-joint disease.

Pathology.—The pathological lesions are those of tuberculosis. The tubercle bacillus is usually found, although it may be absent. The lesions spread and sometimes cause complete destruction of the joint. A characteristic swelling noted in tuberculous knee-joint is caused by an infiltration of the soft parts with a gelatinous substance which must be attributed to a tuberculous process.

Symptoms.—Children old enough to complain will describe pain when moving the joint. A limp is noticed when walking. A swelling of the joint gradually appears. The knee assumes a flexed appearance which is quite typical of this condition. As a result of the swelling in the joint, motion is limited, and the pain at times is very severe. Fever may or may not be present. In a case seen by me recently, although a large quantity of pus was present, no fever could be detected. This condition was one of the usual "cold abscess type."

Diagnosis.—This depends on the limitation of motion, on the swelling, and on the pain. It does not resemble rheumatism owing to the affection being limited to one joint. In rheumatism there is fever, at times very high fever, inflammation, swelling, and a sudden onset of symptoms. Just the reverse condition is found in knee-joint disease.

Prognosis.—The prognosis as a rule is good. Fully 90 per cent. of cases recover, according to Moore. When, however, cases are neglected, ankylosis of the knee-joint results.

Treatment.—Rest in bed, assisted by proper hygiene and a good supporting diet, constitute the general line of treatment to be pursued by the general practitioner. The deformity requires careful orthopædic treatment. A case of this kind usually requires a knee-splint or a plaster cast. It is self-understood that only one competent to do this should guide the treatment. For details regarding the application of knee-splints, etc., the reader is referred to works on orthopædic surgery.

DISEASES OF THE ANKLE-JOINT AND TARSUS.

Tubercular disease frequently affects the ankle and tarsus. The same pathological manifestations described in hip and knee-joint diseases are found here.

Symptoms.—As a rule a limp will be noticed. Associated with this there is swelling of the joint, limitation of motion, and in some cases fever; in other cases, atrophy of the muscles of the leg. The superficial veins are usually enlarged.

Diagnosis.—The slow onset of the symptoms associated with swelling and the limp on walking will usually aid in establishing the diagnosis. It is important to exclude rheumatism by carefully examining other joints of the body. The diagnosis rests upon the disease being limited to one joint in addition to the symptoms above described.

Prognosis.—The prognosis is usually good. Cases usually recover under proper management in six to nine months.

Treatment.—The same treatment described in the article on knee-joint disease applies here. The parts should be given absolute rest. This can be secured by the use of plaster of Paris casts. The rest of the treatment is restorative.

WRIST-JOINT AND ELBOW-JOINT DISEASE.

This condition is rarely met with in children. When, however, tuberculous manifestations exist the symptoms are the same as described in other tubercular joints.

Treatment consists in securing rest and immobility of the parts with the aid of plaster casts. Pus, when present, requires surgical relief. The outcome of these cases is as a rule good.

Joseph S., 10 years old, has been under the treatment of Dr. Dexter Ashley, to whom I am indebted for the illustration. The child was in an extremely anæmic condition, heart and lungs normal, no evidence of tuberculosis. Family history good. Local evidence of tuberculosis involving the elbow-joint, so-called bone tuberculosis.

The boy was able to run about, and excepting this arm seemed to be in a fair physical condition. A comparison of the healthy elbow-joint with the diseased joint is quite interesting. Dr. Ashley's treatment consisted in strict aseptic dressings, tight bandaging, a bandage to support the return circulation and general restorative treatment.

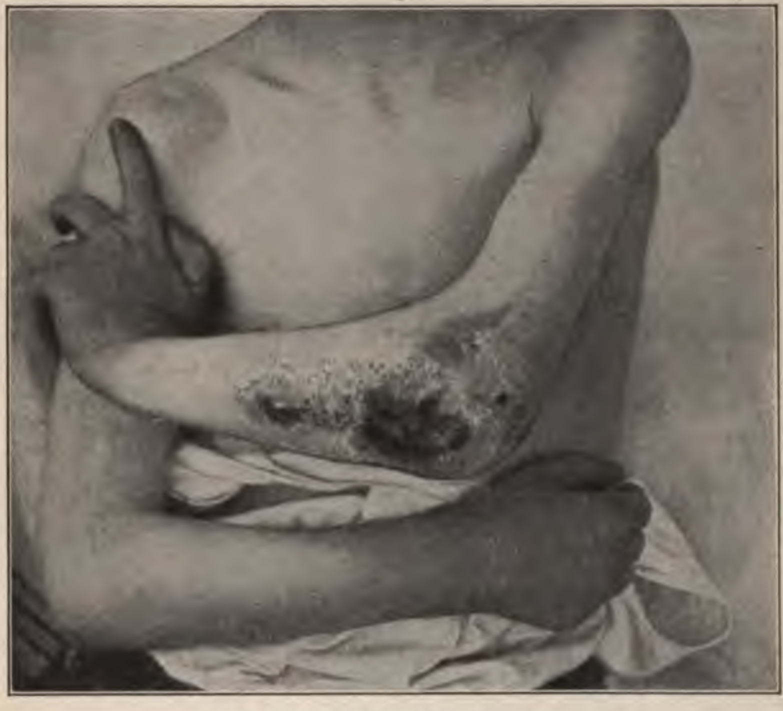


Fig. 300.—Tubercular Elbow-joint.

ACUTE ARTHRITIS (INFECTIOUS OSTEITIS: ACUTE PURULENT SYNOVITIS: ACUTE EPIPHYSITIS: ACUTE OSTEOMYELITIS).

This is an acute inflammatory condition involving a joint. It is always suppurative from the beginning; it is therefore a form of pyæmia. It is an infection originating at the bone in the medullary canal or in the joint.

Etiology.—This condition may follow the acute infectious diseases, especially those which show a tendency to suppurative processes. It most frequently follows measles, scarlet fever, and empyema.

There seems to be no reason to believe that this disease owes its existence to syphilis, tuberculosis, or scrofulosis. Some authors state that a history of traumatism has preceded this infectious disease.

Bacteriology.—Cultures taken of the purulent discharge usually show the presence of the streptococcus pyogenes or the staphylococcus. The point of entrance for the pathogenic bacteria may be either the skin, if abraded, the umbilicus, or the tonsil. In this manner the bacteria gain entrance to the circulation.

Symptoms.—Distinct swelling of the joint can be made out, although the inflammatory condition is deep-seated. The joint is red and inflamed and has a glazed appearance. Fluctuation can be felt if properly palpated. The usual symptoms of inflammation, such as high fever and chills or rigors, are present.

The joints most usually affected are best judged by studying Townsend's collection of cases:—

Hip	38 cases
Knee	27 cases
Shoulder	12 cases
Wrist	5 cases
Elbow	4 cases
Ankle	4 cases
Fingers	2 cases
Toes	1 case
Sterno clavicula	1 case

Diagnosis and Differential Diagnosis.—The diagnosis is easily made if we remember the rapidity with which this condition develops. It may resemble rheumatism, but the acute onset with the fever and the suppuration makes it easy to exclude rheumatism. Syphilis may resemble arthritis, but the fever and suppuration are never present in syphilis.

Prognosis.—If the disease extends rapidly death may occur in a few days. The outcome of the case depends on recognizing the disease in its early stages, and on the rapidity with which the suppurative condition is relieved.

Treatment.—The treatment is surgical. With aseptic care and attention to surgical detail, pus should be evacuated and the joint properly immobilized. To prevent deformity fixation of the joint should be remembered. Restorative treatment should consist in giving arsenic, maltine with hypophosphites, in addition to concentrated food and general hygienic care. The surgical treatment should be given into the hands of a surgeon.

PART XII.

MISCELLANEOUS.

CHAPTER I.

DIETARY.

BEVERAGES.

Albumin Water.—Stir the whites of 2 eggs into $^1/_2$ pint of ice-water, without beating; add enough salt or sugar to make it palatable. Such a mixture is one of the best foods we have for substitute feeding an infant with digestive disturbances when we wish to temporarily stop all milk-food.

Almond-milk.—Take two ounces of sweet almonds, scald them with boiling water; after a few moments express them from the hulls; then pour the hot water away. Put the blanched almonds into a mortar and pound them thoroughly, and add either 2 ounces of milk or 2 ounces of plain water. After this is thoroughly mixed, it is to be strained through cheese-cloth, and the strained liquid will be the almond-milk.

Arrowroot Water.—Add 2 tablespoonfuls of arrowroot to 1 pint of water; allow it to simmer for half an hour, stirring it constantly.

Barley Water.—Take a tablespoonful of pearl barley,[1] grind it in a coffee-grinder, or pound it in an ordinary mortar; add 1 pint of cold water, and allow it to simmer slowly for about an hour. Strain and add enough water to make 1 pint.

Beef Juice.—Expressed beef juice is obtained by slightly broiling a piece of lean beef and expressing the juice with a lemon-squeezer. One pound of steak yields 2 or 3 ounces of juice. This is flavored with salt and given cold or warm. Do not heat enough to coagulate the albumin. This is very nutritious and usually well taken. It may be given at the rate of a tablespoonful three times a day.

Cocoa.—For each large cup take a teaspoonful of cocoa and a teaspoonful of sugar; mix to a paste with a little boiling water or milk; add balance of milk or milk and water, as richness is desired. Let it boil a minute, as boiling improves it.

Chocolate (Unsweetened).—For each breakfastcup take 1 division, break in small pieces, and allow to melt; add milk or milk and water, as richness is desired. Stir constantly. Bring to a boiling point and set aside to simmer. Sugar to taste.

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[1] Prepared barley flour can be procured in pound boxes from the Health Food Company of New York City.

Eggnog.—Heat some milk to a temperature of 150° F., *but do not allow the milk to boil.* When cold, beat up a fresh egg with a fork in a tumbler with some sugar; beat to a froth, add a dessertspoonful of brandy, and fill up tumbler with the warm milk.

Oatmeal Water.—Take a tablespoonful of ordinary oatmeal, and add 1 pint of water. Allow it to simmer slowly for one hour and strain. Add enough water to make 1 pint. The same directions apply to making a household mixture of farina-water, and sago-water, using the same proportions as above.

Rice Water.—One ounce of well-washed Carolina rice. Macerate for three hours at a gentle heat in a quart of water, and then boil slowly for an hour and strain. It may be sweetened and flavored with a little lemon-peel. Useful in diarrhœa, etc., when the flavoring is best dispensed with, and a little old cognac added.

Yolk of Egg Lemonade.—Take the beaten yolk of 1 egg and add to it the juice of $^1/_2$ lemon. Let stand five minutes, thus drawing off the raw taste of the yolk of egg. Add 1 teaspoonful of sugar and 8 ounces of water.

White of Egg Orangeade.—Take the juice of 1 orange and 1 ounce of water, insert an egg whisk, and when the orangeade is in full agitation, add slowly the white of egg. Continue the whisking for two or three minutes more. Add ¼ teaspoonful of sugar.

White of Egg Lemonade.—Leftwich[1] advises the following for a nutritive drink for febrile and wasting diseases:—

℞ Lemons	2
White of eggs	2
Boiling water	1 pint
Loaf sugar to taste.	

The lemon must be peeled twice—the yellow rind alone being utilized—while the white layer is rejected.

Place the sliced lemon and the yellow peel in a quart jug with 2 lumps of sugar. Pour upon them the boiling water and stir occasionally. When cooled to the ordinary temperature, strain off the lemons.

Now insert an egg whisk, and when the lemonade is in full agitation add slowly the white of egg. Continue the whisking for two or three minutes more. While still hot, strain through muslin. Serve when cold.

The white of egg will be found to impart a blandness which makes the addition of sugar almost unnecessary.

This drink is very useful in the febrile diseases of children. It may be given simply as a lemonade, without mentioning the eggs, and will thus be readily taken by the children and difficult patients. It also possesses antiscorbutic properties, which replace those lost from milk by boiling and sterilizing.

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[1] Edinburgh Medical Journal.

SOUPS AND BROTHS.

Chicken Broth.—Cut up a small chicken, put bones and all, with a sprig of parsley, salt, 1 tablespoonful of rice, and a crust of bread, in a quart of water and boil for one hour, skimming it from time to time. Strain through a coarse colander.

Keller's Malt Soup.—Take of wheat-flour 50.0 (about 2 ounces). To this add 11 ounces of milk. Soak the wheat-flour thoroughly, and rub it through a sieve or strainer.

Put into a second dish 20 ounces of water, to which add 3 ounces of malt extract; dissolve the above at a temperature of about 120° F., and then add 10 cubic centimeters (about 2 $^1/_2$ drachms) of 11 per cent. potassium bicarbonate solution. Finally mix all of the above ingredients, and boil.

This gives a food containing:—

Albuminoids	2.0 per cent.
Fat	1.2 per cent.
Carbohydrates	12.1 per cent.

There are in this mixture:

Vegetable proteids	0.9 per cent.

The wheat-flour is necessary, as otherwise the malt soup would have a diarrhœal tendency. The alkali is added to neutralize the large amount of acid generated in sick children. Biedert emphasizes the importance of giving fat, rather than reducing its quantity, in poorly nourished children, and cites the assimilability of his cream-mixture or of breast-milk in underfed children as proof of his assertions. The author has used this malt soup most successfully in the treatment of athrepsia (marasmus) cases in which the children were simply starved.

Mutton Soup.—Cut up fine 2 pounds of lean mutton, without fat or skin. Add 1 tablespoonful of barley, 1 quart of cold water, and a teaspoonful of salt. Let it boil slowly for two hours. If rice is used in place of barley, soak the rice in water over night, if it is to be boiled in the morning.

Oyster Broth.—Cut into small pieces 1 pint of small oysters; put them into $^1/_2$ pint of cold water, and let them simmer gently for ten minutes over a slow fire. Skim, strain, and add salt.

White Celery Soup.—Take $^1/_2$ pint of strong beef-tea; add an equal quantity of boiled milk, slightly and evenly thickened with flour. Flavor with celery seeds or pieces of celery, which are to be strained out before serving. Salt to taste.

PUDDINGS AND DESSERTS.

Calf's-foot Jelly.—Thoroughly clean 2 feet of a calf, cut into pieces, and stew in 2 quarts of water until reduced to 1 quart; when cold, take off the fat and separate the jelly from the sediment. Then put the jelly into a saucepan, with the shells and whites of 4 eggs well mixed together; boil for a quarter of an hour, cover it, and let it stand for a short time, and strain while hot through a flannel bag into a mould. Flavor with lemon.

Baked Apples.—Core and pare 2 tart apples; fill the core-holes with sugar; grate over the apples a little nutmeg; add a little water to baking-pan and put in oven and bake until the apples are soft. Serve with rich milk or cream. Sprinkle with icing sugar, if not sweet enough.

Cornstarch Pudding.—Take 1 pint of milk, and mix with it 2 tablespoonfuls of cornstarch; flavor to taste; then boil the whole eight minutes; allow it to cool in a mould.

Custard Pudding.—Break 1 egg into a teacup, and mix thoroughly with sugar to taste; then add milk to nearly fill the cup, mix again, and tie over the cup a small piece of linen; place the cup in a shallow saucepan half-full of water and boil for ten minutes.

If it is desired to make a light batter pudding, a teaspoonful of flour should be mixed in with the milk before tying up the cup.

Infant's Gelatine Food.—About 1 teaspoonful of gelatine should be dissolved by boiling in 1/2 pint of water. Toward the end of the boiling 1 gill of cows' milk and 1 teaspoonful of arrowroot (made into a paste with cold water) are to be stirred into the solution, and 1 to 2 tablespoonfuls of cream added just at the termination of the cooking. It is then to be moderately sweetened with white sugar, when it is ready for use. The whole preparation should occupy about fifteen minutes.

Junket of Milk and Egg.—Beat 1 egg to a froth and sweeten with 2 teaspoonfuls of white sugar. Add this to 1/2 pint of warm milk; then add 1 teaspoonful of essence of pepsin (Fairchild); let it stand till it is curdled. The above is useful in typhoid and similar wasting diseases.

Jelly Sugar (Price).—This is a combination of refined gelatine sugar and lemon acid. It is very well adapted for children over 2 years of age. It can be made in a moment by adding hot water.

It is very nutritious and easily assimilated, and can be bought with any desired flavor.

Predigested Eggs.—Break a fresh egg. After thoroughly stirring add to it 2 grains of caroid powder and stir thoroughly. The yolk is at once changed into a limpid liquid and soon, though not so quickly, the albumin is completely dissolved. This is done at a temperature of 70° to 80° F.

Predigested Rice.—Take 1/4 pound of rice, add water, and boil until soft. Break grains by passing through a colander. Take, of bana-diatase, 8 grains,[1] and dissolve it in 1 ounce of water and add to the rice, which must be kept warm, but not hot. Let stand for two hours at a temperature of 105° F. When rice is thoroughly softened, season with salt, sparingly. Add a little cream if desired. Serve hot or cold.

Rice Pudding.—Boil a teacupful of rice, drain off the water; add a tablespoonful of cold butter. Mix with it a cupful of sugar, a quarter teaspoonful of ground nutmeg, and a quarter teaspoonful of cinnamon. Beat up 4 eggs very light, whites and yolks separately; add them to the rice; stir in a quart of sweet milk gradually. Butter a pudding dish, turn in the mixture, and bake one hour in a moderate oven.

If you have cold cooked rice, first soak it in the milk, and proceed as above.

Sago Pudding.—Same as above recipe, sago being substituted for rice.

Soft Custard.—Take of cornstarch 2 tablespoonfuls to 1 quart of milk; mix the cornstarch with a small quantity of the milk, and flavor; beat up 2 eggs. Heat the remainder of the milk to near boiling; then add the mixed cornstarch, the eggs, 4 tablespoonfuls of sugar, a little butter, and salt. Boil the custard two minutes, stirring briskly.

Tapioca Cream.—Take 1 pint of milk, 2 tablespoonfuls of tapioca, 2 tablespoonfuls of sugar, 1 saltspoonful of salt, and 2 eggs. Wash the tapioca. Add enough water to cover it, and let it stand in a warm place until the tapioca has absorbed the water. Then add the milk and cook in a double boiler, stirring often until the tapioca is clear and transparent. Beat the yolks of the eggs. Add the sugar and salt and the hot milk. Cook until it thickens. Remove from the fire. Add the whites of the eggs, beaten stiff. When cold, add 1 teaspoonful of vanilla.

MODIFIED COWS' MILK.

Humanized Milk.—A pint of milk is set aside until the cream rises, and this cream is skimmed off and kept. To the milk remaining is added enough rennet to curdle it. The whey is strained off the curd and added, with the previously separated cream, to a pint of fresh cows' milk. This is known as humanized milk. In some infants it will be well borne during the first three months, and to this can be added farinaceous liquid for dilution if required.

Pasteurized Milk.—This is really partially sterilized milk, and consists of sterilization at a temperature of 140° F. instead of 212° F., this sterilization to be continued for from twenty minutes to half an hour. Pasteurized milk should only be used during the twenty-four hours following this process. A good apparatus for this purpose is Kilmer's pasteurizing apparatus.

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[1] American Ferment Company.

Predigested or Peptonized Milk.—This is milk in which the proteids are changed to peptones, or, in other words, digested, by the addition and action of pancreatic ferment. This process may be stopped when partially performed, giving a product of which the taste is not objectionable; or it may be carried on to complete peptonization; when the product has a very bitter, disagreeable taste.

Method.—To partially peptonize milk, add to 1 pint of fresh cows' milk and 4 ounces of water, 5 grains of pancreatic extract and 15 grains of bicarbonate of soda. Allow this to stand at a temperature of 105° to 115° F. for five to twenty minutes, then bring to a boil to kill the ferment, or stand on ice to prevent its further action. If the milk is to be used at once, neither of these latter is necessary.

To peptonize the milk completely, allow the process to continue for one to two hours. After this time the addition of acid produces no coagulation.

In infant-feeding it is better to peptonize a modified than a whole milk. Peptonized milk is frequently very useful in feeding an infant with feeble digestive powers; but it is unwise to continue its use over too long a period, as then the infant's stomach, being called on to do no work, becomes enfeebled from disuse, and gradually unable to perform its proper function.

Whey.—By coagulating 1 pint of fresh (raw) milk by adding a teaspoonful of essence of pepsin, and allowing this to stand, a solid curd is formed swimming in a liquid (whey). This has the following composition: Proteids, 0.86 per cent.; fat, 0.32 per cent.; sugar, 4.79 per cent.; salts, 0.65 per cent.; water, 93.3 per cent.

This at times makes a very valuable food for infants in cases of gastric or intestinal disorder, where the use of milk must for a time be interdicted. Babies like it, it is very easy of digestion, and does not irritate the stomach.

When such whey is added to milk for an infant under 6 weeks take of whey, 2 parts; milk, 1 part. This can be increased until equal parts of milk and whey are used for a child several months old.

Preparation of Sweet Whey.—Sweet whey is best made by the following method: For each pint of whey needed take 1 quart of raw milk or fat-free milk, heated to 37.7° C. (100° F.), and add 8 cubic centimeters (2 drachms) of the essence of pepsin or some of the preparations of liquid rennet. This will precipitate the casein in the form of a curd, which is then broken up with a fork; the fluid which remains is the whey. This is strained through two thicknesses of boiled cheese-cloth and one thickness of absorbent cotton and slowly cooled to a temperature of 10° C. (50° F.), and kept on ice until needed. If the whey is to be mixed with cream, it must first be heated to 65.5° C. (150° F.), in order to kill the rennet enzyme. Whey mixtures should not be heated above 68.3° C. (155° F.)

if one wishes to keep safely under the coagulation-point of the lactalbumin. Add 1 teaspoonful of cane-sugar to each pint of liquid.

MISCELLANEOUS.

Milk Toast.—Take 1 cupful of milk, $^1/_2$ teaspoonful of cornstarch, $^1/_2$ teaspoonful of butter, 2 slices of dry toast, 1 saltspoonful of salt. Scald the milk. Add the moistened cornstarch. Melt the butter in a saucepan; when hot and bubbling, pour in the hot milk slowly, beating all the time until smooth. Let it boil up once. Then add the salt. Toast 2 slices of bread. Pour the thickened milk over the slices. Let it stand a few minutes. Serve.

Scraped Beef.—Scraped beef is prepared by scraping with a dull knife some raw or underdone lean beef. Add salt and serve on bread or biscuit.

Scrambled Eggs.—Take 2 eggs, a pinch of salt, 2 tablespoonfuls of milk, and a small piece of butter. Beat the eggs lightly, add the salt and milk. Put the butter into a saucepan, when melted and hot, add the eggs. Stir until of a soft creamy consistency. Serve on buttered toast.

Soft-boiled Eggs.—Drop 2 eggs into enough boiling water to cover them. Let them stand on the back of stove, where the water will keep hot, but not boil, for eight minutes. An egg to be properly cooked should never be boiled in boiling water, as the white hardens unevenly before the yolk is cooked. The yolk and white should be of a jelly-like consistency.

CHAPTER II.

THE ADULTERATION OF MILK.

FORMALDEHYDE IN MILK.

THE adulteration of milk by the use of formaldehyde is becoming more common than is generally suspected. For a time its use was a "trade secret," but it has been so thoroughly advertised that every obscure individual who has a milk route is now familiar with the preservative qualities of formaldehyde. In our large cities the health officers are on the watch, and hence in these its use is being curtailed, but in the smaller towns and villages the people have not this protection. It would be well, therefore, for physicians to guard against this and keep it in mind when mysterious illness develops in milk-users. They should also be prepared to make an analysis of milk at any time as to its freedom from the drug. This is a simple procedure, and yet one that requires considerable technical skill in the use of some of the tests. The *Lancet-Clinic* gives the various methods for testing formaldehyde as laid down by Herman Harms, some of which are quite simple:—

Rimini Test.—(*A*): Phenyl-hydrazine muriate, 0.5 gram; distilled water, 100 cubic centimeters; dissolve. (*B*): Sodium nitroprusside, 0.5 gram; distilled water, 30 cubic centimeters; dissolve. (*C*) Soda, U.S.P., 15 grams; distilled water, 60 cubic centimeters; dissolve. To 15 cubic centimeters of the suspected milk in a test-tube add 10 drops of *A*, mix and add 3 drops of *B;* mix and let 5 drops of *C* run in slowly on the side of the test-tube. In the presence of formaldehyde a blue color is instantly produced, changing, on standing, to red. On adding to the mixture of milk and solution *A*, 2 drops of ferric chloride solution, and then about 2 cubic centimeters of concentrated hydrochloric acid, a red color is produced, which later changes to orange-yellow. In sour milk the above-mentioned blue is supplanted by green. The Rimini test is easily applied, and readily detects formaldehyde when present to the extent even of 1 part in 25,000 or 30,000.

Phloroglucin Test.—Dissolve 1 gram of phloroglucin in 100 cubic centimeters of distilled water. Put 10 cubic centimeters of the suspected milk in a test-tube and add 5 cubic centimeters of the phloroglucin solution; shake and add 1 cubic centimeter of solution of potassa (U.S.P.). If formaldehyde is present, a red color is developed at once, fading usually, within five or ten minutes; hence the color must be observed at once. One part in 20,000 gives a decided reaction.

Hehner's Test.—To 15 cubic centimeters of concentrated sulphuric acid in a test-tube add 1 or 2 drops of ferric chloride test solution (U.S.P.) and mix. Then pour upon this, in such manner as not to mix the layers, the suspected milk. A violet color indicates the presence of formaldehyde. In the case of cream dilute the cream with an equal volume of water, and then apply the test as above described. The violet color is sometimes produced at once, but oftener not for five or ten minutes, and sometimes not for an hour or so, depending on the amount of formaldehyde present. By this test 1 part in 10,000 or 15,000 is readily detected.

Liebermann Phenol Test.—In the presence of small traces of formaldehyde, distill off from the milk a few cubic centimeters, and add to this 1 drop of very dilute aqueous phenol solution. Then pour this mixture slowly upon concentrated sulphuric acid in a test tube solution so as to form a layer. A bright crimson color appears at the zone of contact. This is easily seen in as little as 1 part in 200,000, and in greater proportion in 1 to 100,000. There is a milky zone above the red color, and, if more concentrated, there will be a whitish or pinkish precipitate. Sometimes the zone will appear in about one hour, one-tenth of an inch below the line of contact.

Hydrochloric Test.—Fifteen or 20 cubic centimeters of suspected milk, together with 2 or 3 cubic centimeters of strong hydrochloric acid, are boiled for a few minutes in a test-tube. A red coloration indicates formaldehyde. Other tests are known, but they are more complicated and require apparatus or reagents not kept by the average pharmacist. The above tests are all simple in their application and afford a ready means of detecting formaldehyde in milk and cream.

Remarks on the Foregoing Tests.—The Rimini test is highly recommendable. The reaction in sweet milk appears rapidly and with certainty. Hehner's test, as well as the phloroglucin and phenol tests, are very reliable and are all extremely sensitive. The hydrochloric acid test is very simple, but is not to be depended on; it may show formaldehyde in most instances; however, cases have come under our observation when it has utterly failed to show the reaction, probably because of the milk having undergone some unknown changes. The Liebermann test is simple, delicate, and shows formaldehyde very readily.

As corroborative evidence, it is well, after the tests are finished, to let the suspected milk or cream stand in a warm place for twenty-four hours. A pure sample will invariably turn sour and separate. A sample which has been "doctored" with formaldehyde, however, will show, at the end of twenty-four hours, but a very slight separation, if indeed any at all, and will have but a slight odor.

A Word of Caution.—It is desirable that all test solutions be freshly prepared, especially the nitroprusside of sodium solution in the Rimini test, and that the suspected sample be as fresh as possible. Sour samples are difficult to test, and may yield variable results, because in these formaldehyde has been oxidized, and is no longer present as formaldehyde. In carrying out the tests for formaldehyde it is advisable to work the suspected sample and the one known to be pure side by side. Finally, do not expose your tests or have your milk placed where a bottle of formaldehyde is being opened, for the vapor is very penetrating, and you thus may be easily led to misleading results. When formaldehyde has been found to be present by at least three of the aforementioned tests, it may be considered that its presence has been shown.

CHAPTER III.

THE EXAMINATION OF THE GASTRIC CONTENTS IN CHILDREN.[1]

CHEMICAL EXAMINATION.[2]

AFTER the removed chyle is filtered it is ready for the following tests:—

Hydrochloric Acid.—Free hydrochloric acid turns Congo-red a deep blue color; but as the presence of large quantities of lactic and other organic acids gives the same reaction, and as the phloroglucin-vanillin (Günzburg's reagent) does not respond to the organic acids, it is better not to depend upon the simpler Congo-red test. One or two drops of the filtered stomach-contents are placed on a white porcelain dish; the same amount of the reagent is added and thoroughly mixed with a glass rod; the dish is then gently warmed over the flame. The appearance of a bright cherry-red color on the edge of the residue indicates the presence of free hydrochloric acid.

To 10 cubic centimeters of the filtered chyle add 1 drop of phenolphthalein solution; to this add drop by drop from the burette a decinormal solution of potassium or sodium hydrate until after thoroughly stirring, a pink color persists; now read carefully the number of cubic centimeters of the alkali solution used, multiply by 10 and 0.00365 (the decinormal factor of HCl) and the result is the percentage of HCl. If sufficient material is at hand, the estimation should be repeated to avoid possible error.

Lactic Acid (Uffelmann's Test).—One drop of the solution of ferric chloride is added to 20 cubic centimeters of the $^1/_2$ per cent. carbolic acid solution; this is diluted till a transparent amethyst blue color is obtained. A few drops of the fluid to be tested added to a few cubic centimeters of this solution in a test-tube, change the amethyst-blue to a canary-yellow if lactic acid be present. On account of the presence of various other substances this test is sometimes not distinctive when the untreated chyle is used. A more certain procedure is to add to 10 cubic centimeters of the filtered chyle in a test-tube 110 cubic centimeters of ether; shake thoroughly;

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[1] With a soft flexible catheter I syphon the gastric contents about two hours after feeding; if the stomach is irritable and children vomit, then the vomited material is used.

[2] I am indebted to Boas' valuable book on "Diseases of the Stomach" for many points in the chemical examination and methods used.

allow the ether to separate; decant the ether into a clean test-tube; place the test-tube containing the ether in a glass of warm water till the ether has evaporated; add 5 to 10 cubic centimeters of distilled water to the residue, and test as above for lactic acid.

Propeptone.—To 5 cubic centimeters of chyle, add 5 cubic centimeters of saturated solution of sodium chloride and 2 drops of acetic acid. A cloudiness or precipitate indicates propeptone, especially if the precipitate disappears on heating and returns on cooling.

Peptone.—Filter out any propeptone from the last named; add an excess of sodium hydrate solution; mix thoroughly and add 1 or 2 drops of a weak solution of copper sulphate ($^1/_2$ per cent.); the appearance of a violet-red or old-rose color indicates peptone. This is the so-called biuret reaction which most peptones and albumoses give.

Pepsin.—For this test we require uniform, small pieces of coagulated albumin; these should be little circular slices of hard boiled white of egg, 1 centimeter in diameter and 1 millimeter in thickness, which may be preserved in glycerine. One of these discs is placed in a test-tube containing 5 cubic centimeters of filtered chyle and kept at a temperature of 99° F.; if it has been already shown that hydrochloric acid is absent, 1 drop or 2 of dilute hydrochloric must be added. The tube is observed every twenty to thirty minutes to note the progress of digestion and the time required for complete disappearance of the egg albumin.

Rennet.—Add a few drops of chyle to 5 or 10 cubic centimeters of milk and place tube in water at a temperature of 99° F.

Motility.—The motility of the stomach may be tested in various ways: probably the salol-test, although open to many objections, is the most used.

This test finds the foundation for its use in the fact that salol is not absorbed until it reaches the alkaline secretions of the intestine, by which it is decomposed. The test is untrustworthy when the stomach secretion is alkaline. The time between ingestion and the appearance of salicyluric acid in the urine is noted by examining the urine at intervals of one-half and one hour after taking 15 grains of salol (immediately after meal). If salicyluric acid be present in the urine, the addition of a few drops of a solution of ferric chloride gives a violet color. If the appearance of the test be delayed longer than an hour or an hour and fifteen minutes, the motility is usually considered below normal.

CHAPTER IV.

URINE.

Method of Collecting Urine.

In collecting urine from an infant we can apply a pad of sterile absorbent cotton or a flat sterile sponge to the vulva. After urination the urine absorbed can be filtered into a bottle. If the urine thus secured is not sufficient for examination, the method can be repeated several times. In boys the smallest size rubber ice-bag can be drawn over the genitals and a specimen secured in this manner.

If for any reason this method cannot be carried out, and it is vital that the examination be made, then an infant's size catheter may be used to draw off the urine.

The First Urine.

The first urine drawn by catheter is acid, almost always clear and but slightly colored. During the first four or five days it is more or less cloudy from the presence of epithelial cells from the urinary passage, and uric acid salts. The specific gravity averages about 1012. The sediment always contains normal epithelial cells, various forms of uric acid crystals, and now and then hyaline casts. The amount of urine is small (Morse). This is due in part only to the insufficient supply of milk, as the amount is also small in bottle-fed infants. It increases rather rapidly about the fourth day, 20 to 50 cubic centimeters being passed in the first three days, and about 100 cubic centimeters on the fourth day. In the second week it averages between 200 and 300 cubic centimeters.

The proportion of water eliminated in the urine to that taken in the food is greater after the fourth day, averaging 22 per cent. to 25 per cent. before, and 50 per cent. to 60 per cent. after.

The urine of breast-fed babies almost never contains indican, that of the artificially fed baby usually but slight traces. Urobilin is never present in that of the breast-fed, seldom in that of the artificially fed. It does not contain albumin, and sugar is absent with the ordinary reagents. The sediment is slight, and consists entirely of cells. One-third to one-half gram of urea per kilo of body weight is said to be passed in twenty-four hours. Figures are of but little use, however, as the amount of urea varies with the character of the food. It is pretty certain, nevertheless, that from 40 to 50 per cent. of the nitrogen ingested appears in the urine. The amount of urine is relatively large. It varies between 200 and 500 cubic centimeters from one to six months, and between 250 and 600 cubic centimeters up to 2 years.

The urine of the new-born is rich in sodium chloride, which salt diminishes with age. During the first and second months of life it is in the same proportion as in adults. From the third to the fifth year, computed by kilogram weight, the amount is 0.57 gram; at 11 years, 0.44 gram, and at 16 years, 0.18 gram.

Phosphoric acid is seldom found, but when met with it is always in very minute quantity.

Uric acid is present in the earliest urine, and the quantity regularly increases up to the third day, when it rapidly diminishes.

On examining the kidneys of a new-born, the papillæ will be found filled with a reddish substance which obstructs the urinary ducts; this, as is well known, is nothing more than uric acid infarction and has no pathological significance.

Parrot and Robin found urate of soda, sulphate of calcium, magnesium, potassium, benzoic acid, allantoidin, and mucin, and Cruse denies the presence of sugar, oxalate of calcium, or hippuric acid. Creatinine and indican are not found in the urine of the new-born or wet-nursed. Xanthine is relatively abundant in cases of nephritis.

In infantile atrophy, as may be presumed, the quantity of urine is far below the normal; it is yellow, acid reaction, often contains organic deposits, sugar, albumin and an excess of urea and phosphates.

In icterus neonatorum the urine is pale-yellow, and contains urates, epithelial cells, and yellow masses of pigment.

The urine of infants with scleroderma is reddish, acid with uratic deposits, and slight excess of urea.

ALBUMIN.

The presence of albumin is always of importance, although not always due to an inflammatory process of the kidneys. It is often the sign of a simple congestion in athrepsia, cholera infantum, general or intestinal tuberculosis, intestinal catarrh, typhoid and scarlet fever.

"A small amount of albumin in the form of nucleo-albumin is almost constantly present in the urine during the first four days of life. It often persists for two weeks, and not infrequently for two months. There is much difference of opinion as to the cause of this albuminuria. It has been attributed to the changes in the circulation at birth, to hyperæmia resulting from the changes in the metabolism after birth, to renal disease in the mother, and to irritation from uric acid. It is doubtful if any of these explanations are correct. The latest investigations show that albuminuria is no more common in the children of women suffering from nephritis or eclampsia than in others. If uric acid is the cause, its action is probably as a chemic rather than as a mechanic irritant. Many observers regard this albuminuria as physiologic. It is hardly safe to consider it so, however, until more is known about metabolism, the changes due to nourishment, and disturbances of nutrition in the new-born. Whatever the cause, it is certainly not a serious condition, and ought not to be looked upon as the forerunner of chronic nephritis in later life."

In older children the presence of albumin in the urine is always pathological, except when it is the physiological result of the administration of certain drugs (tincture of iodine, etc.).

A slight amount of albumin may be found in nephritic colic due to the stimulus which the uric acid exerts upon the renal parenchyma. At other times, when present, there is an actual inflammation of the kidneys, as in scarlatina and diphtheria; there may be an amyloid degeneration without its being possible to discover any albumin in the urine.

Sometimes children will be found pale, the urine perhaps abundant or diminished in quantity; it will contain albumin, a few hyaline casts, uric acid and epithelium, yet they will have good appetite, will play and appear otherwise quite well. Others become languid, lose their appetite, complain of headaches, painful micturition, and will pass a turbid and sedimentous urine. In these cases albumin soon appears.

The more severe cases suffer from anuria; partial œdema will occur in the eyelids, on the dorsum of the foot, etc. The next day the amount of urine will have been 50 to 100 grams in twenty-four hours. This will increase, perhaps, never to return to the normal.

The color of the urine in Bright's disease will be variable, according to the amount of blood which it may contain, of acid reaction, and average specific gravity of 1010 to 1015. Under the microscope we find red and white corpuscles, hæmatin, renal epithelium, hyaline or granular casts, uric acid crystals, fat globules, and detritus.

Chronic nephritis may be the result of an acute affection complicating scarlet fever. In these cases children suffer but little and seldom show more than a few œdematous spots.

These forms of kidney involvement are rather rare, and cases which have been diagnosed as such have, on autopsy, proven to have been cases of amyloid degeneration due to syphilis, malaria, rachitis, struma, or tuberculosis.

In the mild forms of diphtheria the urine suffers no change whatever, but in the general infection, even in the early stages, albuminuria is found, which is a fairly positive evidence of systemic infection. If the urine diminishes in quantity and blood corpuscles are found under the microscope we may feel sure that the diphtheritic process has invaded the kidney, or else that a nephritis complicates the diphtheria.

"In rachitis, albuminuria is comparatively rare; the quantity does not change materially, but the calcium salts have been found in marked diminution. Marchand and Lehman have discovered lactic acid present. The phosphates and chlorides are in very small quantities. The urine of leukæmic patients at times contains albumin and many lymph corpuscles as well as hyaline casts. The uric acid and hypoxanthine are in greater quantity.

"Diabetes mellitus has been met with at a very tender age.

"In a case of pseudo-hypertrophic paralysis Dennen reports marked glycosuria.

"Hæmoglobinuria is found in Winckel's disease, and the same as in adults, in malaria, syphilis, and as a result of exposure to cold.

"Hæmaturia and pyuria have no special significance beyond that which they have in adults.

"Uric acid is in excess during the first week and is a physiological phenomenon; later on, deposits of urates and uric acid appear in the course of serious diseases of the digestive apparatus. Under other circumstances, the oxidation of nitrogenous substances being diminished (by diseases of the respiratory or central nervous system), deposits of oxalate of calcium occur.

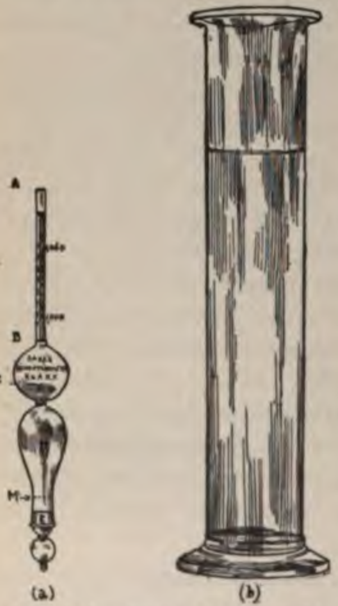

Fig. 301.—Urino-Pyknometer,[1] for estimating the specific gravity of small volumes of urine.

"Infarcts of uric acid may be found even up to the seventh or eighth week. Children will strain, make repeated efforts and cry out during urination; the diapers will be found stained with a darker urine than usual; the edges of the wet surface will be seen reddened by a yellowish-pink sandy deposit. A careful analysis of this urine regularly shows an excess of uric acid, many epithelial cells, a few pus corpuscles, and mucus and traces of albumin. Quite frequently the urine is so acid as to produce such pronounced evidences of pain on the part of the infant as are met with in the nephritic colic of adults.

"When tubercle bacilli are present in urinary sediment, the diagnosis of tuberculosis of the kidneys, ureters, or bladder may be positively made. Care should be exercised not to confound the tubercle bacillus with the smegma bacillus, which may often be present in the same specimen of urine and which stains like the former, though it decolorizes differently.

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[1] It can be procured at Eimer & Amend, chemists' supplies, New York City.

"The epithelium found in urinary sediments is often of great importance in determining in what part of the genito-urinary tract the lesion exists, and a knowledge of the histology of these organs will sometimes prove invaluable.

"The presence of echinococcus, filaria, etc., determines the exact nature in those diseases.

"Dysuria is not always a manifestation of renal or vesical disease, since a high fever may at times originate it. In such cases children complain or cry out on attempting to urinate.

"This symptom belongs as well to affections of the external genitals such as phimosis, urethritis, congenital anomalies of the urethra, those of the labia minora in females, etc."

Specific Gravity.—The specific gravity of the urine is best taken with a hydrometer. If the urine is very scanty an instrument called the urinopyknometer, devised by Dr. Saxe, should be used. It has the advantage of giving the specific gravity when only 1 drachm or 3 cubic centimeters can be procured.

TEST FOR ALBUMIN.

Place in a test-tube about half a teaspoonful of pure water, in which dissolve one of the potassio-mercuric iodide tablets and one of the citric acid tablets. To this solution gradually add, drop by drop, the urine. If a gelatinous precipitate occurs, it may consist of albumin, an alkaloid such as quinine, or peptone. To determine which of these three substances was originally present in the urine, heat the contents of the tube to the boiling point and note if the precipitate is redissolved. If such be the case, the precipitation was due to peptone and not albumin, as the latter would be coagulated and would not be dissolved. If the precipitate consists of a compound of the reagent with an alkaloid, it will be dissolved completely upon the addition of alcohol, a result which would not occur if the precipitate consisted of albumin. The potassio-mercuric iodide test is exceedingly sensitive, and whenever the results are negative, no precipitate occurring upon the addition of the urine, it is positive evidence of the absence not only of albumin, but of peptone and alkaloids as well. It is only in such cases where a precipitate occurs that it becomes necessary to apply alcohol and heat tests to determine the character of the precipitate.

Directions for Use.—In testing urine for albumin with nitric acid, fill the large tube of the horismascope two-thirds full of the urine, which must be made perfectly clear and transparent, if necessary by filtration. Then pour into the funnel tube 25 or 30 minims of nitric acid, which will pass down through the capillary tube and form a layer underlying the urine.

If albumin is present, a distinct white zone will presently appear at the point of contact, sharply defined against the black background, the amount of albumin being indicated by the density of the opaque ring. Sometimes air will remain in the capillary tube of the instrument, preventing the acid from running down the tube. It is always best to see that the tube is free from air before pouring in the acid. If air is present, it can generally be driven out by merely tilting the instrument or it may be driven down the tube by placing the thumb or middle finger on top of the funnel so as to cover it completely and pressing quickly and forcibly so as to cause a few bubbles of air to pass through the urine.

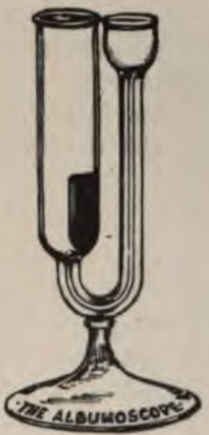

Fig. 302.—The Horismascope or Albumoscope. A new instrument for determining the presence and amount of albumin in the urine. No liability of the acid mixing with the urine. The slightest visible trace of albumin can be instantly detected against the dark background. Color reactions due to urinary and biliary pigments are clearly shown against the white background.

In the use of the horismascope in applying the nitric-acid test for albumin, these advantages are secured:

1. The acid when it comes in contact with the urine is of full strength, rendering the test much more delicate than as ordinarily applied.

2. The reaction is not liable to be obscured by separation of uric acid or acid urates, such separation not taking place in the horismascope until after a considerable interval.

3. The black and white backgrounds of the instrument render much more distinct the effects produced by the reagent.

4. No especial skill is required on the part of the operator.

The faintest visible trace of albumin as shown by the nitric acid test may be stated to be $^1/_{80}$ per cent. One-fourth of 1 per cent. is just sufficient to make the albumin layer opaque when viewed from above. If larger amounts are present the percentage may be approximately estimated by diluting the urine until the opacity is reduced to that corresponding with 0.25 per cent.

There are many other tests which can be advantageously made by introducing the reagent from beneath, allowing it thus to form a distinct stratum underlying the fluid to be tested.

In testing a specimen of urine it is always best to first determine its reaction. For this purpose red and blue litmus paper should always be at hand. A small piece of each kind of paper should be added to the specimen and the result be observed. If the urine is alkaline the red litmus paper will turn blue, and if it is acid the blue litmus paper will turn red. It is very important that when testing for sugar the urine should be slightly alkaline, and when testing for albumin it should be slightly acid. In order to render the specimen slightly alkaline or slightly acid according to the test that is to be applied, sodium carbonate tablets and citric acid tablets should be used.

Robert's Albumin Test.

℞ Sat. sol. magnes. sulph. (c. p.)	5 ounces
Nitric acid (c. p.)	1 ounce

This test is a cold one, viz.: put about 1 cubic centimeter of solution into medium-sized test-tube—incline on a steady rest on an angle of 45 degrees. With a slender pipette allow the filtered urine to be tested—to flow very slowly down the side of the tube. It will float above test solution. Use about 1 cubic centimeter of urine. Examine in front of the window by daylight, with aid of black background. A sharp clear-cut, white line will appear at contact line if albumin is present. A wide band of white is not always indicative of albumin, neither is a narrow zone above in the urine, which may be due to mucus. The sharp, clear-cut zone is distinctive.

A New Test for Albumin.[1]—This new and simple test is based upon the following facts:—

1. Albumin is coagulated by carbolic acid.

2. Equal volumes of non-albuminous urine and a mixture, composed of equal parts of carbolic acid and glycerine, form an emulsion which clears up entirely upon agitation, leaving a perfectly transparent and highly refractive liquid.

3. Equal volumes of albuminous urine and the above mentioned carbol-glycerine solution, when mixed together, produce a white turbidity, which remains, in spite of agitation, and does not precipitate on standing nor redissolve.

The test is very sensitive, distinctly showing the presence of 0.1 per cent. of albumin in the urine, the degree of turbidity being proportionate to the percentage of albumin contained in the urine.

Test.—Two cubic centimeters of carbol-glycerine solution are poured into a small test-tube, and 2 cubic centimeters of the filtered urine are added. Mix thoroughly with a glass rod, or agitate. If a clear, transparent liquid results, there is no albumin present; but if the slightest turbidity is noticeable the urine is albuminous.

The Diazo Reaction in Urine.—The diazo test was suggested by Ehrlich, in 1882, as a valuable diagnostic measure in typhoid fever, although he admitted the occurrence of this reaction in a few other conditions shortly to be considered.

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[1] Fuhs, Medical Record, March 8, 1902.

The diazo reaction depends upon the fact that if sulphanilic acid (amidosulphobenzol) be acted upon by HNO, diazosulphobenzol is formed, which unites with certain aromatic substances occasionally present in the urine to form aniline colors.

Friedenwald has recently reviewed the literature of this reaction, and showed that many of the contradictory results obtained by some observers are due to failure in carrying out Ehrlich's methods in performing the test, which is best accomplished as follows:—

To obtain diazosulphobenzol in a perfectly fresh condition sulphanilic acid is kept in solution with hydrochloric acid; to this sodium nitrate is added, whereupon HNO is liberated and diazosulphobenzol is formed.

Process.—Two solutions are prepared, as follows:—

1. Two grams of sulphanilic acid, 50 cubic centimeters of hydrochloric acid, 1000 cubic centimeters of distilled water.
2. A 0.5 per cent. solution of sodium nitrate.

In performing the test, 50 parts of No. 1 and 1 part of No. 2 are mixed, and equal parts of this mixture and of the urine in a test-tube are rendered strongly alkaline with ammonia. If the reaction be positive the solution assumes a carmine-red color, which on shaking must also appear on the foam. Upon standing for twenty-four hours a greenish precipitate is formed.

The test must not be considered positive unless a distinct red coloration extends to and includes the foam on shaking.

Diazo Reaction in Nurslings and Children.—"The diazo reaction never appears in the urine of healthy nurslings.

"High temperatures in children do not affect the reaction.

"Catarrhal pneumonia (acute) and also chronic does not give the reaction.

"Diphtheria and varicella do not give this reaction.

"Otitis, coryza, lymph-adenitis, omphalitis, bronchial catarrh, pleuritis, gastro-intestinal catarrh, colitis, congenital syphilis, eczema, and erythema give no reaction.

"Erysipelas and morbilli almost always give this reaction.

"The severer the attack of erysipelas or measles, the more pronounced the reaction, and when intensity of the disease vanishes the reaction loses its strength. In lethal cases the reaction remains until death is plainly pronounced. Therefore the *intensity of the disease* and the reaction go hand in hand.

"The reaction can be found in the urine of nurslings one or two days before exitus, no matter what the nature of the disease.

"The prognosis can at times be guided by the intensity of the reaction, for the more severe the disease the greater the reaction.

"The reaction is most commonly found in typhoid fever from the fourth to the seventh day and thereafter, and if the reaction be absent the diagnosis is doubtful.

"Cases of typhoid fever characterized by faint reaction and occurring only for a short time may be predicted to be of very mild type.

"The reaction is occasionally noted in phthisis pulmonalis, but only in cases pursuing a rapid course toward a fatal termination.

"The reaction is sometimes, but not often, observed in cases of measles, miliary tuberculosis, pyæmia, scarlet fever, and erysipelas.

"In diseases unaccompanied by fever, as chlorosis, hydræmia, diabetes, diseases of the brain, spinal cord, liver, and kidneys, the reaction is always absent."

The weight of clinical evidence strongly confirms all of Ehrlich's original claims for this reaction, but more especially so with regard to typhoid fever and pulmonary tuberculosis; if present in the latter disease any length of time, the prognosis is very unfavorable.

INDICAN.

Detection of Indican.—Jaffe's method consists in mixing 10 cubic centimeters of strong hydrochloric acid with an equal volume of urine in a test-tube, and, while shaking, add drop by drop a perfectly fresh, saturated solution of chloride of lime, or chlorine water, until the deepest obtainable blue color is reached. The mixture may next be titrated with chloroform, which readily takes up the indican and holds it in solution, and the quantity present may be approximately estimated according to the depth of the color. If the urine contains albumin it should be removed before applying this test, otherwise the blue color, often arising from the mixture of hydrochloric acid and albumin after standing, may prove misleading.

TEST FOR SUGAR IN URINE.

The best test for sugar is furnished by the indigo and sodium carbonate tablets. This test is applied by first placing in a test-tube about half a teaspoonful of water, one of the indigo and sodium carbonate tablets, and one of the sodium carbonate tablets. Heat the contents of the tube gently until solution is effected, and then add 1 drop of the urine to be tested, *keeping the fluid at the boiling point without allowing it to boil.* If no effect is produced add a second drop of the urine and heat as before. If no change of color results add another drop of the specimen, and so on until at least five drops have been added. If any notable amount of sugar is present, one or at least two drops will suffice to bring about the reaction. The fluid will change from pure blue to amethyst, then to purple and red, finally fading to a pale yellow. If the quantity of sugar is very small, the color will change only to a purple or red, and in nearly every case five drops of normal urine will produce this change.

If one drop of the urine produces a strong reaction, dilute the urine to one-half, one-quarter, one-eighth, etc., in succession until a single drop ceases to produce a visible change, and estimate roughly in this manner the quantity of sugar present. While observing the various changes of color which the liquid undergoes, if sugar is present, any agitation of the solution should be carefully avoided. The reason for this precaution is readily explained by the fact that the original blue color of the solution may be restored by simply shaking the liquid. This remarkable effect is not due to cooling, but to the oxidizing influence of the air.

In regard to the comparative value of tests for sugar, it may be said that the copper test is the least trustworthy. Among the normal constituents of the urine, uric acid is capable of reducing copper compounds, and numerous substances which may accidentally be present have a similar action. The indigo test is capable of detecting a smaller quantity of sugar in the urine than any other reagent. One drop of a solution of glucose, containing a half grain to the fluidounce, shows a distinct reaction.

Whitney's Test (for Sugar).[1] — The following table will give the amount of sugar in analytical testing:—

TABLE No. 106.

If Reduced by	It Contains to the Ounce	Percentage.
1 minim	16.0 grains or more	8.38
2 minims	8.0 grains	1.67
3 "	5.33 "	1.11
4 "	4.0 "	0.83
5 "	8.20 "	0.67
6 "	2.67 "	0.56
7 "	2.29 "	0.48
8 "	2.0 "	0.42
9 "	1.78 gram	0.37
10 "	1.60 "	0.33

The Method of Procedure.—Heat 1 drachm of the reagent in a test-tube to boiling; add the urine slowly, drop by drop, until the blue color begins to fade; then more slowly, boiling three to five seconds after each drop, until the reagent be *perfectly colorless, like water*, or until 10 drops only are added.

It will be noted after reduction that the reagent, on cooling, resumes the blue color again. This change is due to the absorption of oxygen from the atmosphere, changing the reduced suboxide held in solution to the blue protoxide again. This should not be mistaken for imperfect reduction or defect in the reagent. The change takes place quickly by shaking the tube, and the reduction can be repeated, if done immediately, before the evaporation of the ammonia by the addition of the saccharine urine as before, though not with the same degree of accuracy.

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[1] Physicans can procure the reagent, accurately compounded as described, from the Lewis Chemical Company.

When a specimen of saccharine urine contains a large amount of albumin, the reduction takes place without interference by the albumin present, but leaves the reagent more or less of a yellow tint, according to the amount. A large amount of coloring matter has a similar effect, but there is little danger of uncertainty when not more than ten minims are used.

CHAPTER V.

BACTERIOLOGICAL MEMORANDA.[1]

DEMONSTRATION OF TUBERCLE BACILLI IN SPUTUM.

WITH a forceps pick out a thick, purulent portion of the sputum. Make a thin spread between a slide and a cover-glass. Allow this to dry thoroughly in the air or it can be dried by holding it several inches above a Bunsen burner. Stain with several drops of Ziehl's solution and heat it over a Bunsen burner:—

Ziehl's solution:—

℞ Fuchsin	1 gram
Alcohol	10 grams
Carbolic acid	5 grams
Water	100 grams

After heating wash the cover-glass in water, and lastly add several drops of Gabbet-Ernst solution:—

℞ Methylene blue	2 grams
Diluted sulphuric acid (25 per cent.)	100 grams

Rinse this solution off the cover-glass, dry between filter paper, and mount with Canada balsam.

Under the immersion lens the tubercle bacilli will be stained red, and all other bacteria will have the blue background.

Aqueous Solutions.—Aqueous solutions of methyl violet, gentian violet, fuchsin, and the other aniline dyes are prepared by adding 1 cubic centimeter of the saturated alcoholic solutions of the desired dye to 20 cubic centimeters of distilled water. This will impart a decided color to the liquid so that a pipette full will be barely transparent.

The true aqueous solutions are made by dissolving the dyes in water, but these are weak and not so effective as those prepared from the alcoholic solutions. These solutions deteriorate in a short time. The carbol-fuchsin and alkaline methylene blue will keep a little longer, but they require to be filtered occasionally.

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[1] The reader is referred to works on bacteriology (such as Lenhartz-Brooks) for blood examinations in malaria, anæmia, leukæmia, and for the Widal reaction of the blood in typhoid fever.

GONOCOCCUS.

With a platinum loop pick out a thick purulent portion of the discharge. Make a thin spread between two slides. Dry in the air or over a Bunsen burner. Stain with methylene blue for half a minute. Rinse this solution off the slide. Dry between filter paper and mount with Canada balsam.

DIPLOCOCCUS PNEUMONIÆ.

With a platinum loop pick out a thick portion of the sputum. Make a thin spread between two cover-glasses. Immerse in a watch-glass of aniline gentian violet for ten minutes. Pass through water, and place in Gram's iodine solution for five minutes. Wash in alcohol until no further color comes away. Place on edge to dry. Mount in Canada balsam.

KLEBS-LOEFFLER BACILLUS.

Bacteriological method of diagnosis is given in detail in chapter on "Diphtheria." Bacillus stains well with Loeffler's alkaline methylene blue.

STREPTOCOCCUS.

Usually found in purulent ear, eye, or nasal discharges, sometimes in vaginitis.

With a platinum loop pick out a thick portion of the discharge. Make a thin spread between two slides. Dry in the air or over a Bunsen burner. Stain with methylene blue or fuchsin solution. Mount in Canada balsam.

MENINGOCOCCUS.

Lumbar puncture fluid in cerebro-spinal meningitis should be spread between two cover-glasses and dried over a Bunsen burner. Stain with methylene blue. Mount in Canada balsam.

CHAPTER VI.

ANÆSTHETICS IN CHILDREN.

NITROUS OXIDE AND ETHER.

The ideal anæsthetic for children is a combination of nitrous oxide and ether. Whenever it is possible *one skilled in its administration should be employed.* The *responsibility of attending to a* major or minor operation is so great that unless *one skilled in the administration of an anæsthetic* is employed there may be serious after-effects. To properly guard the heart and respiration requires experience, and no surgeon should undertake to do both, excepting in extreme emergencies.

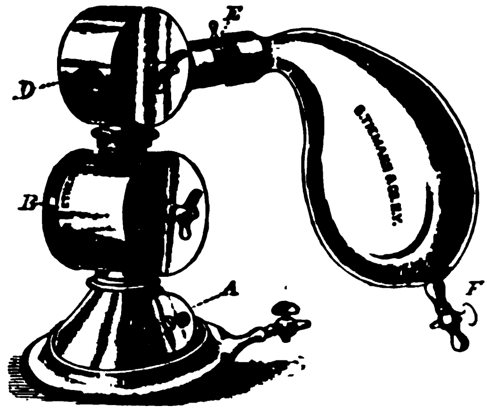

Fig. 303.—Gas and Ether Inhaler.

Walter K., 5 years old, was given a mixture of nitrous oxide and ether by Dr. Culler. The child was anæsthetized without a struggle. I removed the adenoids and hypertrophied tonsils. The child showed no evidence of shock. There was slight nausea. No other evidence of gastric disturbance. There were no after-effects.

CHLOROFORM.

Chloroform vapor is decomposed into chlorine and hydrochloric acid by the presence of the common gas flame, and may thus give rise to irritating effects upon the respiratory organs.

When employed it should be administered by the drop method. By this method, combined with fresh air, the danger is minimized. The statistics of Dr. George Gould, of Philadelphia, and the Lancet Commissioner, prove that choloform anæsthesia causes more deaths than ether as an anæsthetic.

ETHYL CHLORIDE.

In my own practice I have seen chloroform more than once cause death while being administered to a struggling child. In a case of empyæma reported by me (see article on "Empyæma") there was such respiratory disturbance that the idea of giving a general anæsthetic had to be abandoned. After the part chosen for operation had been properly cleaned I used an ethyl chloride spray until the part was thoroughly anæsthetized. An incision was made, the operation completed, and a drainage tube inserted without the patient showing evidence of severe pain.

ETHER.

Sulphuric ether, used alone as an anæsthetic in children, may be considered. It requires a much longer time to produce its effect, although it has no depressing effect upon the heart. Statistics show that in 300,175 administrations of ether there were 18 deaths. Out of 638,461 of chloroform, there were 160 deaths, showing the following ratio:—

Chloroform mortality	1 to 3,749
Ether mortality	1 to 16,675

We therefore see that ether is by far the safer anæsthetic. Weir states that "ether narcosis is safer, even though the kidneys are slightly affected." Ether is frequently combined with oxygen, and, as previously stated, with laughing gas, and forms in the latter combination *the safest anæsthetic for children.*

Regarding the Effect of Ether in Affections of the Air Passages.—Affections of the air passages following ether narcosis are usually the result of aspiration of infected mouth contents. Ether causes a slight increase of mucous secretion. It has no irritant action on the tracheal or bronchial mucous membrane. When bronchitis or pneumonia exists, greater care must be taken owing to the increased secretion produced by the ether, as stated above. When nitrous oxide is given we avoid the irritant effect just described.

In adenoid operations, give nitrous oxide until cyanosis is seen, then give ether; the change relieves cyanosis at once.

Lymphatic Enlargement in Children.—Most deaths occur in children in which the lymphatic condition exists—the so-called lymphatic diathesis.

The Children's Clinic at Graz, during the last twenty years, shows that records of fatalities with chloroform always revealed the lymphatic hyperplasia, which is the principal feature of the so-called constitutio lymphatica. (Read chapter on "Status Lymphaticus.")

Ewing believes the above conditions prevail in America. Lartigan's report of the Roosevelt Hospital shows that death came after ether as well as after chloroform, in children affected by the lymphatic constitution.

The presence of universal enlargement of the lymph nodes without direct inflammatory cause, hypertrophied tonsils, adenoid hyperplasia, tendencies to anæmia, weakness of pulse, irregular heart's action, along with insufficient development of the heart and large blood-vessels, show that the lymphatic condition exists.

LOCAL ANÆSTHESIA BY THE INJECTION OF STERILE WATER.[1]

When the heart, lungs, or kidneys contraindicate the use of a general anæsthetic, then local anæsthesia should be tried. Gant advises the use of regional injections of sterile water in the part to be incised. He claims that an abscess can be opened or similar surgical work performed without pain by this means. It is well worth trying.

INTRA-SPINAL ANÆSTHESIA.[2]

Corning, of New York, about twenty years ago found that anæsthesia could be produced in the lower part of the body by injecting cocaine in the lumbar region of the spine. The patient is placed in a sitting position well bent forward, and firmly held during the injection. The skin should be cleaned in the usual antiseptic way, followed by an ethyl chloride spray. This renders the introduction of the needle practically painless. A point one-half inch to either side of the median line and midway between the spinous processes is taken, and the needle pushed forward, inward, and upward. Special effort is made to keep away from the central part of the spinal canal by a close relation of the needle point to the dura. The instrument used is of the simplest kind. A small-sized, steel aspirating needle with a short-beveled pointed end, having a well-fitted hypodermic barrel, answers every purpose. As nearly as possible the same amount of cerebro-spinal fluid is allowed to escape as of the injection medium which is to be introduced. The injection is given slowly, usually taking one and one-half to two and one-half minutes. Often the first evidence that the cocaine is taking effect is some dilatation of the pupils or a slight nausea.

This method has been especially valuable where circumcision is to be performed, or where the examination of the bladder is to be made. In children I have frequently found considerable nausea and vomiting following the use of cocaine; the same is also true of eucaine. The analgesic effect of eucaine is in some cases as good as that of cocaine.

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[1] For details of this method, see article of Gant's, published in the New York Medical Journal, January 23, 1904.

[2] The technique of lumbar puncture is described in article on "Meningitis" (page 827).

Dose Required.—Five, rarely ten minims of freshly prepared 2 per cent. cocaine solution are required. The solution should be freshly prepared for each case, by dissolving the eucaine or cocaine in sterile water. It is well to remember that there are certain toxic effects noted in some children. This should be borne in mind, and individual idiosyncrasies noted.

CHAPTER VII.

DISINFECTION.

We know that pathogenic bacteria abound in the false membrane, in the sputa, and in the secretions of the diseased mucous membrane, and also in the stools and urine. Physicians and nurses are particularly exposed to the danger of infection when examining or swabbing the throats of patients, through the coughing of mucus or particles of membrane into their faces. Bacilli frequently abound in the form of dust. They can withstand drying fourteen days. They may retain their virulence four to seven months, in dark, damp, and cold places.

Disinfections to be Used as Means of Prevention.—As a means of prevention the following may be recommended:—

Corrosive sublimate	1 to 10,000
Cyanide of mercury	1 to 10,000
Chloroform water.[1]	
2 per cent. carbolic acid in 30 per cent. alcohol.	
Turpentine and alcohol equal parts with 2 per cent. carbolic acid added.	

The above solutions are to be used to prevent the development of the bacilli on the adjacent mucous membrane. Great care should be taken in using poisonous solutions in the treatment of children.

Paraform is extensively used and recommended.

Clinical thermometers and all instruments should be disinfected in carbolic acid solution immediately after being used. The nurse or attendant on the patient should observe the same precautions as the physician, who, after handling the patient or touching anything about him, should disinfect his hands in a basin of 3 per cent. carbolic solution, which together with a nail-brush should be kept constantly on hand in the sick room. When practicable, a room at the top of the house should be chosen in which to place the patient. All superfluous objects, curtains, carpets, ornaments, etc., which are liable to catch dust should be removed, only articles necessary for the patient's comfort being left in the room. Good ventilation must be maintained. A sheet kept constantly moistened with carbolic acid solution should be tacked in the doorway, making it necessary to push it to one side in going in and out of the room, thus making the isolation more perfect. All children belonging to a family in which an infectious disease has occurred should be prevented from attending school for a shorter or longer period, never less than four weeks.

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[1] Chloroform water is made by saturating a pint of water with a drachm or 2 of pure chloroform and pouring off, after several vigorous shakings, so that none of the chloroform passes over.

The *presence of insects in the sick room,* especially flies, should be guarded against as much as possible, in view of the fact that they may act as carriers of the disease. No food should be allowed to stand uncovered in the sick room, as in certain cases pathogenic organisms may gain access and multiply therein.

Sputa are best disinfected by steam sterilization, together with the sputum cups. The addition of 15 grams of sal-soda to a liter of water materially aids the process of cleaning.

Urine and fæces are best treated together by means of milk of lime In this we possess the most valuable agent for the disinfection of typhoid and cholera stools. This agent is prepared as follows: To unslaked lime, placed in a jar, as much water as it will absorb is added. The unslaked lime is stirred up with 4 parts of water to form the milk of lime, and this is mixed intimately with the discharges until the mixture gives a strong alkaline reaction (tested by litmus paper).

Chloride of lime, to be effective, must contain 25 per cent. of available chlorine. Six ounces to the gallon of water represents the standard solution.

Carbolic acid, unless in combination with sulphuric, and corrosive sublimate are *not suitable* for the disinfection of stools.

Discharges can also be disposed of by burning after being mixed with sawdust.

Water-closets are best disinfected by chloride of lime solution.

CHAPTER VIII.

THE ADMINISTRATION OF DRUGS TO CHILDREN.

A FEW points concerning the use of drugs in children should noted:—

1. Give the minimum dose of a drug in the beginning of a disea
2. Administer the drug in a palatable form.
3. The soluble tablet triturates should be administered, as they c bine a minimum quantity with solubility and palatability.
4. Remember the idiosyncrasies of drugs and guard against toxic d by watching the effect of a drug in any given case.
5. In some specific diseases such as diphtheria, give a sufficient qu tity of antitoxin to obtain a therapeutic result.
6. Certain drugs, for example, belladonna, calomel, quinine, stry nia, bromoform, and alcohol, *when cautiously administered* can be gi in very large doses. It is only necessary to note the physiological eff and then to give the drug until its point of tolerance is reached.

Accuracy in dealing with poisons is very important in children. is surprising to see the difference in size of various teaspoons on the mark I advise using a medicine glass, which is graduated with teaspoon, etc.

CHAPTER IX.

LOCAL REMEDIES.

COLD COMPRESSES.

Cold compresses may be made out of linen or cheese-cloth folded several times and wrung out in ice-water. If there is any abrasion of the skin, 1 part of glycerine should be added to every 5 parts of water. If constant cold is wanted, compresses should be changed frequently.

HOT COMPRESSES OR FOMENTATIONS.

Hot compresses or fomentations are made by wringing out a piece of flannel in hot water. As this is oftentimes hotter than the hands can stand, the flannel may be placed in a towel, two ends being kept from the water and then wrung out in the towel by twisting the ends. In applying fomentations they should not be hotter than can be borne by the face of the mother or nurse. To retain the heat they may be covered with oil silk, oil paper, or oiled muslin, and then with a dry towel. Renew when cool.

POULTICES.

A poultice is intended to supply heat for a greater period than a fomentation. It should not be more than one-half inch in thickness.

A flaxseed poultice is made as follows: A sufficient quantity of water is heated, and when brought almost to the boiling point, the flaxseed meal should be added slowly, stirring all the while to avoid lumping. The meal may be added until it has the consistency of hot mush, too thick to flow. This may be spread on a piece of linen or cotton cloth, the edges turned over slightly and the part to which it is to be applied next to the body must be covered with an old handkerchief or thin piece of linen. See that it is not hot enough to burn the skin. The poultice should be larger than the affected area. Afterward cover with oil silk or paper to keep out the air, and then bandage in place. This can be renewed every hour or so. Have everything ready when the poultice is made, as it quickly cools when exposed to the air.

TURPENTINE STUPES.

Turpentine stupes are found very useful in cases of abdominal pain. A piece of flannel is wrung out in hot water, the same as in a fomentation, except a little soap or oil added to the water. A little turpentine should then be sprinkled evenly over the surface of the flannel, about 30 drops to each square foot or a teaspoonful may be added to the water. Apply the same as a fomentation.

MUSTARD PLASTERS.

Mustard plasters for infants should be made with 1 part of mustard to 3 or 4 parts of flour or flaxseed meal. Add warm water and stir until of the proper consistency. Spread thinly on a cloth and apply directly to the skin. It is to be kept on until the skin is reddened, not blistered.

GINGER POULTICE.

Ginger poultice is made in the same way as that described for the making of mustard plasters, and has its advantages in that it will not blister.

CANTHARIDAL COLLODION.

In using the cantharidal collodion care should be exercised to remove all moisture and excretions from the skin before applying, otherwise the cantharidin, being soluble in water, will not come into contact with the skin. One of the most convenient methods of preparing the skin for the application of cantharidal collodion is to wash the part with vinegar or dilute acetic acid.

VENESECTION (BLOOD LETTING).

Local blood letting is frequently a valuable therapeutic aid, especially in meningitis and in cerebral pneumonia, in fact, wherever symptoms of cerebral hyperæmia are noted. Convulsions are sometimes prevented by relieving congestion with the aid of a few leeches. Baginsky reports the value of venesection as a routine measure in certain types of diseases, such as continued convulsions, in which relief can be afforded by this means. The skill of the surgeon is necessary, for we must consider the possibility of infection while opening a vein.

DRY CUPPING.

The application of dry cups is useful in marked dyspnœa. It is therefore indicated in asthma, broncho-pneumonia, and in pulmonary œdema, two cups may be applied on each side posteriorly for several minutes. If relief is afforded, they can be applied once every twelve hours.

CHAPTER X.

RECTAL MEDICATION IN CHILDREN.

When the stomach is irritable in young children I prefer to medicate per rectum. The gastric mucous membrane will sometimes show an intolerance for drugs. It is advisable, especially in exhaustive diseases, such as diphtheria, typhoid fever, and the intestinal disorders, to support the strength of the body with nutrition. In such cases vomiting may be provoked by the administration of drugs. Children will frequently object to taking medicine, and it is painful to watch the struggle between mother and child while attempting to force the medicine into the infant's mouth. In such cases, especially in very young infants with whom we cannot reason, the rectum should be chosen as the proper channel for the introduction of the drug. The rectum absorbs slowly but surely.

The following drugs may be given per rectum and the doses gradually increased:—

Aconite may be given in suppository, but shows its action only in large doses. We must therefore administer it in repeated small doses to obtain its effect. For example, we may give 1 or 2 drops of the tincture in a suppository to a year-old child.

Belladonna acts as an excellent sedative in cough, and exerts a very favorable influence on the muscle fiber of the intestine. We may use $^1/_6$ minim of extract of belladonna in twenty-four hours, divided into three or four suppositories, for every two years of age.

Bromides should be given in doses of 3 grains for each year of life, in two suppositories; $^3/_4$ grain if it is to be continued. In severe spasm we may give two grains for each year of life, in two suppositories rapidly following each other; for example, in laryngismus stridulus.

Caffeine is usually injected subcutaneously. It may, however, be administered in a suppository with equal parts of benzoate of sodium. For example, one and one-half grains to a suppository, using two daily for each year of the child's life.

Digitalis.—Powdered digitalis is with difficulty absorbed by the rectum. The tincture should, therefore, be used. The maximum dose for each year of life is 4 drops, divided into two suppositories.

Iodine and its preparations are exceptionally well borne by the rectum, and fully absorbed. Three grains for each year of life, in two suppositories, is the maximum dose; $^3/_4$ grain if it is to be continued.

Mercury should only exceptionally be given per rectum, and then only in the form of calomel, $^3/_4$ grain in a suppository for each year of life.

Nux Vomica.—One-sixth of a grain for every two years, in three suppositories.

Strychnine should only be given to children over 10 years of age.

Salicylic Acid.—Seven and three-quarter grains for each year of life, in divided doses (three or four).

Quinine is best given in suppositories. The daily maximum dose is 2 to $3\,^1/_3$ grains, in two suppositories, for each year of life.

Antipyrine may be given in the same dose as quinine.

Opium.—Pulvis opii may be given in suppositories, in doses of $^1/_{64}$ grain for each year of the child's age, and this dose may be repeated in severe cases every two hours.

Toxic symptoms should be carefully watched for, and the use of the remedy discontinued on their appearance. These doses are small ones and may be increased.

CHAPTER XI.

PRESCRIPTIONS FOR VARIOUS DISEASES.

The following prescriptions have served the author and are in use at one of his clinics in New York City:—

SUMMER DIARRHŒA.

℞ Calomel tablets, $^1/_{10}$ grain.

One every two hours for a child 1 to 2 years old.

Followed by (next day):—

℞ Bismuth betanaphthol, 5 grains.
Every two hours in water. Or

℞ Mist. creta, 2 ounces.
Teaspoonful every two hours. Or

℞ Bismuthi subnit., 20 grains.
Misturæ cretæ comp., 4 drachms.
Aquæ, q. s. ad 2 ounces.
M. Teaspoonful every two hours.

GASTRO-ENTERITIS.

℞ Castor oil.

Teaspoonful every two hours for one day.

If diarrhœa persists after flushing the colon and rectum and also washing the stomach, after using former remedies:—

℞ Eudoxine, 5 grains.
Every three hours.
The diet is most important.

PERSISTENT VOMITING.

Lavage (stomach washing) with table salt one teaspoonful to quart of warm water (100° F.). Then leave stomach rest for at least six hours.

MOUTH-WASH.

Pulv. acid. boric. solution (1 per cent.).

STOMATITIS OR APHTHÆ.

℞ Solut. Kali Permangan. (1 per cent.).

Dilute with equal parts of warm water. Wash three times a day.

TONIC AFTER EXHAUSTIVE DISEASE, SUCH AS PNEUMONIA OR SUMMER DIARRHŒA.

℞ Ferri pyrophos., 1 drachm.
Quininæ sulph., $^1/_2$ drachm.
Strych. sulph., ¼ grain.
Acid phosph. dil., 2 drachms.
Aquæ, q. s. ad 4 ounces.
M. Teaspoonful three times a day.

TONIC AND RESTORATIVE.

℞ Ferri et quiniæ citrat., $^1/_2$ drachm.
Syrup hypophos. comp., 4 drachms.
Aquæ, q. s. ad 2 ounces.
M. Teaspoonful after each meal.

TONIC FOR CHOREA.

℞ Liq. potass. arsenitis, ½ drachm.
Ferri et ammon. citrat., 1 drachm.
Aquæ, q. s. ad 2 ounces.

M. Teaspoonful three times a day. Increase gradually.

PERTUSSIS.

℞ Bromoform (Merck), 1 drachm.
Tinct. cardamom comp., 1 drachm.

M. D. S.: Five drops in water three times a day for a child 1 year old.

Add 1 drop for every two years, thus:
6 drops for baby 3 years old
7 drops for baby 5 years old

Or:—

℞ Fl. ext. belladonna, 10 drops.
Mist. glycerrhiz. comp., q. s. ad. 2 ounces.

M. D. S.: Teaspoonful every two hours for a child 2 to 4 years old; younger children $^1/_2$ the dose.

Or:—

Apply ung. belladonna over surface of chest every second night.

Capillary Bronchitis.

When expectoration is viscid:—

℞ Ammon. carbonat., 10 grains.
Syr. senega, 4 drachms.
Syr. prun. virg., 6 drachms.
Aquæ camph., q. s. ad 2 ounces.

M. D. S.: Teaspoonful every two hours with water.

Acute Catarrhal Bronchitis.

℞ Ammon. muriat., 15 grains.
Ammon. bromid., 20 grains.
Syr. liquorit, 6 drachms.
Tinct. opii camph., 2 drachms.
Aquæ, q. s. ad 2 ounces.

M. D. S.: One-half teaspoonful every two hours.

Pleurisy.

(Cough with pain, on breathing.)

℞ Pulv. Doveri, 10 grains.
Pulv. ext. liquorit, 20 grains.
Sacch. albi, 30 grains.

M. ft. chart. no. 20.

M. D. S.: One powder every three hours.

Tubercular Cough.

℞ Creosote carbonate.
Five drops in milk, soup or broth three times a day, for a child 2 years old.

Persistent Diarrhœa, with Tubercular Symptoms.

℞ Guiacol carbonate, 3 to 5 grains.
For a child 1 year old.

Entero-colitis.

℞ Tinct. kino, 20 minims.
Misturæ cretæ comp., 1 drachm.
Aquæ, q. s. ad 2 ounces.

M. Teaspoonful every three hours.

Colitis, with Pain.

℞ Tinct. opii camph., 10 minims.
Bismuthi subnit., 2 grains.
Aquæ calcis, q. s. ad 4 drachms.

M. Teaspoonful every two hours.

Atonic Dyspepsia, with Constipation.

℞ Pulv. rad. ipecacuanhæ, 1 grain.
Pulv. rad. rhei, 10 grains.
Sodii bicarbonat., 1/2 drachm.
Tinct. nucis vomicæ, 15 drops.
Aquæ, q. s. ad 2 ounces.

M. Teaspoonful before each feeding.

To Abort Acute Tonsillitis.

℞ Creosote, 8 drops.
Tinct. myrrh, 2 ounces.
Glycerine, 2 ounces.
Aquæ, 4 ounces.

M. D. S.: Gargle every hour.

Acute Tonsillitis.

℞ Tinct. aconit. rad.
One drop every hour for six doses to a child 1 to 5 years old.

Infantile Eczema.

(Dry, vesicular and papular.)

Leistikow recommends:—

℞ Zinci oxidi, 1 drachm.
Amyli, 1 drachm.
Adipis lanæ, 1 drachm.
Petrolati, 2½ drachms.
Hydrar. oxid. flav., 4 to 8 grains.

M. ft. pasta.

Kistler employs the following ointment to relieve the itching of infantile eczema:—

℞ Salicylic acid, 15 grains.
Bismuth subnitrat., 4 drachms.
Powdered starch, 1 1/2 drachms.
Cold cream, 2 ounces.

Calomel, in the dose of 1 or 2 grains, is indicated from one to three times a week, to aid in the elimination of pathologic products.

STIMULATING EXPECTORANT USEFUL IN BRONCHITIS.

℞ Ammon. carbonat., 1/2 drachm.
Tinct. senegæ, 20 drops.
Tinct. opii camphorat., 3 drachms.
Syr. tolutan, 5 drachms.
Aquæ, q. s. ad 6 ounces.

M. Teaspoonful every two or four hours. Diluted with water.

TUBERCULOSIS.

℞ Creosote carbonate, 30 drops.
Spiritus frumenti, 4 drachms.
Glycerinæ, 4 drachms.
Aquæ, q. s. ad 4 ounces.

M. Teaspoonful every four hours or oftener.

VAGINITIS.

℞ Alum, powdered, 1 ounce.
Or:—
℞ Zinc sulphate, 1 ounce.
Or:—
℞ Borax, 1 ounce.

Sig.: A tablespoonful to a quart of water to be used as a vaginal injection three or four times a day. Apply a sterile pad of cheese-cloth. A fresh pad to be applied after each irrigation.

FEVER MIXTURE.

℞ Tr. aconite rad., 16 drops.
Spir. mindererus, 2 ounces.

M. Sig.: One-half teaspoonful every hour for a child 2 to 4 years old.

HYPODERMIC MEDICATION.

When immediate relief is required, hypodermic medication should be given. The rapid action of hypodermic medication is best shown in giving a dose of apomorphia hypodermically for the relief of spasmodic croup.

CHAPTER XII.

Remedies Most Frequently Administered.

For hypodermic use the dose should be half that used by the mouth. *For use by rectum* the dose should be twice that used by the mouth.

Dose for Children.—Dr. Young's rule: Add 12 to the age, and divide the age by the result.

Example.—For a child 2 years old, $\frac{12+2}{2}=\frac{1}{7}$. The dose should be $^1/_7$ that for an adult.

In giving powerful medicines and opium still smaller doses must be used for children.

TABLE OF DOSES.

Owing to the toxic effect, drugs marked "*" must be given with greater caution.

Remedies.	Grains or Minims for Child Three Years Old.
*Acid, arsenious	0.003 to 0.01
benzoic	1 to 3
boric	1 to 2
camphoric (to check night-sweats)	3 to 6
*carbolic	0.1 to 0.3
gallic	0.6 to 3
gallic (in albuminuria)	2 to 12
hydrobromic, diluted	2 to 12
hydrochloric, diluted	1 to 4
*hydrocyanic, diluted	0.4 to 1.2
nitric, diluted	1 to 4
nitrohydrochloric, diluted	1 to 4
phosphoric, diluted	1 to 6
salicylic	1 to 4
sulphuric, aromatic	1 to 3
sulphuric, diluted	1 to 6
sulphurous	6 to 12
tannic	0.4 to 2
*Aconitina (white crystals)	0.0007 to 0.001
*Adonidin (heart-tonic)	0.02 to 0.065
Agaricin (to check night-sweats)	0.025 to 0.05
Aloes	0.4 to 1
Aloinum	0.025 to 0.6
Ammonii benzoas	2 to 4
bromidum	1 to 6
carbonas	0.6 to 2
chloridum	2 to 6
iodidum	0.4 to 3
valerianas	0.4 to 3
*Amyl nitris (inhaled or internally)	0.4 to 1
Amylene hydrate (hypnotic)	2 to 12
Antimonii et potassii tartras (diaphoretic)	0.01 to 0.02
et potassii tartras (emetic)	0.2 to 0.4
oxysulphuret	0.1 to 0.4
Antipyrin	0.4 to 3
Apiol	1 to 2

Remedies.	Grains or Minims for Child Three Years Old.
Apomorphine hydrochloride	0.0065 to 0.02
Argenti nitras	0.035 to 0.1
*Arsenii iodidum	0.003 to 0.02
*bromidum	0.003 to 0.012
*Atropinæ sulphas	0.0015 to 0.006
*Auri et sodii chloridum	0.006 to 0.025
Bismuthi subnitras	1 to 12
salicylas	1 to 4
*Bromoformum (in whooping-cough, etc.)	1 to 2
Caffeine	0.2 to 1
Calcii chloridum hydratum	1 to 4
Calcii lacto-phosphas	1 to 2
Camphora	0.6 to 2
monobromata	0.4 to 1
Cerii oxalas	0.2 to 2
Chinoidinum	0.6 to 6
Chloral	0.6 to 4
Chloralamidum (hypnotic)	3 to 12
Chloroformum	0.2 to 6
Chrysarobinum (eczema)	0.035 to 0.6
Cinchonidina, and its salts	1 to 6
Cocaina (locally, ¼ per cent. solution), internally	0.012 to 0.1
Codeina	0.012 to 0.4
*Colchicine	0.002 to 0.004
Confectio sennæ	12 to 24
*Coniina, and its salts	0.002 to 0.035
*Creolin (locally, ½ to 2 per cent. solution), internally	0.1 to 1
Creosotum	0.1 gradually increased
Croton-chloral	0.2 to 1
Cupri acetas	0.025 to 0.1
sulphas (emetic)	0.012 to 0.05
*Digitalinum	0.003 to 0.006
*Digitalis	0.025 to 0.4
*Duboisina, and salts	0.0015 to 0.0033
*Elaterinum (U. S. P., 1880)	0.0035 to 0.016
Emetina, and salts (emetic)	0.025 to 0.05
Ergota	3 to 12
Ergotinum	0.4 to 1.6
*Erythrophlœina (local anæsthetic, heart-tonic)	0.012 to 0.025
*Eserina, and its salts	0.003 to 0.01
Ethyl chloride (local anæsthetic)	
Exalgin (analgesic; give with alcohol)	0.4 to 1.2
Fel bovis purificatum	1 to 2
Ferri arsenas	0.01 to 0.035
bromidum	0.2 to 1
carbonas saccharatus	0.4 to 3
et ammonii citras	1 to 2
et ammonii tartras	1 to 3
et potassi tartras	2 to 6
et strychninæ citras	0.2 to 1
hypophosphis	1 to 2
iodidum saccharatum	0.4 to 1
lactas	0.2 to 0.6
oxidum hydratum cum magnesia (antidote to arsenic)	fʒ 0.8 to fʒ 1.6 frequently
pyrophosphas	0.2 to 1
subcarbonas	1 to 6

REMEDIES.	GRAINS OR MINI FOR CHILD THREE YEARS O
Ferri sulphas	0.2 to 0.6
sulphas exsiccatus	0.1 to 0.5
valerianas	0.2 to 0.6
Ferrum dialys	0.2 to 3
reductum	0.2 to 1
Gaultheria, oil of	0.6 to 2
Guaiacol (constituent of creosote)	0.05 to 1
Guaiacol carbonas *vel* benzoas	0.065 to 2
Homatropinæ hydrobromidum (mydriatic, locally, 0.2 per cent. to 4 per cent.)	0.035 to 0.5
*Hydrargyri chloridum corrosivum	0.003 to 0.02
*chloridum mite	0.012 to 2
*Hydrargyri iodidum rubrum	0.004 to 0.02
iodidum vir.	0.035 to 0.2
subsulphas flava (as emetic)	0.4 to 1
Hydrargyrum cum creta	0.6 to 1.6
Hydrastine	0.6 to 1
Hydrogenii dioxidum (10-volume solution), locally, (25 to 100 per cent.), antiseptic	6 to 24
*Hyoscinæ hydrobromas	0.001 to 0.0035
*Hyoscyaminæ sulphas	0.001 to 0.003
Ichthyol (locally, 10 to 50 per cent.), internally	0.6 to 1
Infusum digitalis	fʒ 0.2 to fʒ 0.8
Iodoformum	0.2 to 1
Iodol	0.035 to 0.1
Iodum	0.02 to 0.05
Ipecacuanha (expectorant)	0.035 to 0.2
" (emetic)	3 to 6
Jalapa	3 to 6
Liq. ammonii acetatis	fʒ 0.4 to fʒ 1.6
acidi arseniosi	Commencing doses to be increased cautiously 0.2 to 1
arsenii bromidi	
arseni et hydrargyri iodidi	
potassii arsenitis	
sodii arseniatis	
ferri chloridi	0.4 to 2
ferri dialys	2 to 6
potassii citratis	fʒ 0.4 to fʒ 0.8
Lithii benzoas	1 to 4
bromidum	1 to 4
carbonas	0.4 to 2
citras	1 to 4
salicylas	1 to 6
Lupulinum	1 to 6
Magnesii carbonas	3 to 12
citras, gran.	ʒ 0.4 to ʒ 1.6
sulphas	2 to 6
Mangani oxidum niger	0.2 to 1
Methylene blue with powdered nutmeg (malarial fevers)	0.2 to 1
Mistura chloroformi	fʒ 0.2 to fʒ 1.6
ferri et ammonii acetatis	fʒ 0.2 to fʒ 0.8
glycyrrhizæ composita	fʒ 0.2 to fʒ 0.8
potassi citras	fʒ 0.8 to fʒ 3.2
rhei et sodæ	fʒ 0.8 to fʒ 1.6
Morphina, and its salts	0.012 to 0.1
Morrhuol (derivative of cod liver-oil)	0.6 to 12
Moschus	0.4 to 3
Naphthol	0.4 to 1
*Nitroglycerinum (trinitrin), ½ per cent. solution	gtt. 0.5 increased

REMEDIES.	GRAINS OR MINIMS FOR CHILD THREE YEARS OLD.
Oleoresina aspidii (filix mas)	3 to 12
Opium (14 per cent. morphine)	0.025 to 0.4
Ouabaine (in whooping-cough)	0.0002 to 0.0008
Phenocoll hydrochloride	1.6 to 3
*Phosphorus	0.0015 to 0.004
*Physostigminæ sulphas	0.0015 to 0.004
*Picrotoxinum	0.0016 to 0.004
*Pilocarpina, and salts (cautiously)	0.003 to 0.1
Piperazin	3 (daily)
Plumbi acetas	0.1 to 0.6
Potassii acetas	3 to 12
bicarbonas	1.6 to 12
Potassi bromidum	1.6 to 12
bitartras	0.2 to 0.4
chloras	1.6 to 6
cyanidum	0.01 to 0.025
iodidum	0.4 to 6
nitras	0.4 to 3
permanganas	0.1 to 1
tartras	ʒ 0.2 to ʒ 1.6
Pulvis antimonialis	0.2 to 0.6
glycyrrhizæ compositus	6 to 12
ipecacuanhæ et opii	1 to 3
jalapæ compositus	2 to 12
morphinæ compositus	1 to 3
rhei compositus	1 to 12
Resina copaibæ	0.4 to 2
euonymi	0.4 to 1
guaiaci	1 to 4
jalapæ	0.4 to 1
podophylli	0.016 to 0.1
scammonii	0.4 to 2
Resorcin	0.4 to 1
Rheum	0.4 to 6
Saccharine (substitute for sugar)	0.1 to 1
Salicinum	1 to 6
Salipyrin (antipyretic, antineuralgic)	1.6 to 3
Salol	0.4 to 2
Salophen (antipyretic, antirheumatic)	3 to 4
Santonium	0.05 to 1
Senna	1.6 to 36
*Sodii arsenas	0.003 to 0.02
benzoas	1 to 3
boras (in epilepsy)	1 to 6
bromidum	1 to 6
chloras	0.4 to 1
hyposulphis	1 to 4
iodidum	0.4 to 6
phosphas	0.4 to 24
salicylas	1 to 6
Somnal	6 to 9
*Sparteinæ sulphas (cardiant and diuretic)	0.012 to 0.8
Spiritus ætheris nitrosi	3 to 24
ætheris compositus	3 to 24
ammoniæ aromaticus	3 to 12
camphoræ	1 to 6
chloroformi	3 to 12
Strontii lactas *vel* bromidum *vel* iodidum	3 to 12
*Strychnina, and salts	0.003 to 0.016
Sulphonal (best in hot mint-water)	1 to 4

REMEDIES.	GRAINS OR MINIMS FOR CHILD THREE YEARS OLD.
Sulphur	ʒ 0.1 to ʒ 0.8
Syr. ferri bromidi	1 to 12
ferri iodidi	1 to 6
scillæ compositus	1 to 6
senegæ	fʒ 0.2 to fʒ 0.4
sennæ	fʒ 0.2 to fʒ 1.6
Terebene	1 to 3
Terpin hydrate (tonic expectorant)	0.4 to 1
Tetronal (hypnotic)	3 to 12
Theobrominæ et sodii salicylas (diuretic)	1 to 6
Thymol	0.2 to 1
*Tinctura aconiti	0.1 to 1
aloes	3 to 12
asafœtidæ	6 to 12
belladonnæ	0.4 to 3
cannabis indicæ	1 to 4
capsici	1.6 to 3
cimicifugæ	6 to 12
cinchonæ composita	3 to 24
colchici seminis	1 to 4
conii	1 to 6
*digitalis	0.6 to 3
ferri chloridi	2 to 6
gelsemii	0.4 to 3
guaiaci ammoniata	6 to 12
hydrastis	6 to 24
hyoscyami	1 to 6
*ignatiæ	1 to 6
iodi compositus	1.4 to 3
kino	3 to 24
lobeliæ	1 to 6
moschi	3 to 12
nucis vomicæ	1 to 3
*opii	0.4 to 3
opii camphorata	1 to 48
*physostigmatis	1 to 3
stramonii	1 to 3
strophanthi (cardiant and diuretic)	0.2 to 2
valerianæ ammoniata	2 to 24
veratri viridis	0.6 to 2
*Tolypyrin (antipyretic, antirheumatic)	1 to 4
Tolysal (antipyretic, antirheumatic)	1 to 4
*Trional (hypnotic)	3 to 12
Trituratio elaterini (10 per cent.)	0.025 to 0.2
Vinum antimonii (expectorant and alterative)	0.2 to 1.6
(emetic)	6 to 15
colchici	1 to 3
ergotæ	fʒ 0.2 to fʒ 0.6
ipecacuanhæ (expectorant)	1 to 3
(emetic)	fʒ 0.4 to fʒ 1.2
opii	1 to 3
Zinci acetas	0.1 to 0.4
bromidum	0.1 to 1
iodidum	0.1 to 0.6
oxidum	0.2 to 1
phosphidum	0.02 to 0.035
sulphas (emetic)	3 to 6
valerianas	0.1 to 1

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